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ABSTRACT

The primary purpose of the Symposium was to assist the veterinary medical educator in becoming a more effective and efficient teacher. The main focus was placed on the educational process and on newer ideas in education, with the expectation that application could be made to the totality of veterinary medical education. The Fifth Symposium was planned as a minicourse in design, presentation, and evaluation of learning experiences. The topics of minicourses, multi-media instruction, and mastery learning were emphasized. The meeting attempted to combine the features of a symposium (dining and free exchange), a conference (presentations by outstanding authorities in the field of education, media, and evaluation), and a workshop (individual participation and contribution). The major presentations are published in this volume, and appendices provide a statement of the participant objectives, a list of the program contributors, and the results of a post-symposium questionnaire. (JR)

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Proceedings

Learning Experiences

5th Symposium on
Veterinary Medical Education
June 18-21, 1972

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LEARNING EXPERIENCES

Proceedings

5th Symposium

on

Veterinary Medical Education

June 18–21, 1972

Edited by J. R. Welser

The symposium upon which this publication is based was conducted pursuant to Contract No. NIH 72–4222 with the U. S. Public Health Service, Department of Health, Education, and Welfare.

Sponsored by the American Veterinary Medical Association, Council on Education in cooperation with the Association of American Veterinary Medical Colleges, the University of Georgia College of Veterinary Medicine and the Georgia Center for Continuing Education.

Dedicated

to

Robert Getty, D.V.M., Ph.D.

Dr. Getty was a pioneer in Veterinary Medical Education, especially in the application of media. He was a member of the National Coordinating Committee for the 5th Symposium until his untimely death.

PREFACE

The Fifth Symposium on Veterinary Medical Education was built on the excellent base provided by the previous four symposia. The First Symposium, held at Michigan State University, provided an overview of veterinary medical education. The Second, held at the University of Georgia, focused its attention primarily on clinical education. The Third Symposium, again held at Michigan State University, dealt with pre-veterinary programs; while the Fourth Symposium, held at Texas A & M University, reviewed graduate education. After having considered the various components of our education program, it was appropriate that the Fifth Symposium focus on the educational process and newer ideas in education with the expectation that application could be made to the totality of veterinary medical education.

The Fifth Symposium was sponsored by the American Veterinary Medical Association in conjunction with the Association of American Veterinary Medical Colleges. It was initiated in 1970 when the American Veterinary Medical Association's House of Delegates authorized its development. Partial funding was obtained from the National Institute of Health. The National Coordinating Committee consisted of Doctors R. E. Brown, University of Missiouri; J. Lieberman, Video Record Corporation; N. E. Hutton, Iowa State University; W. M. Decker, A.V.M.A. Office representing the A.V.M.A.; and Doctors C. F. Reed, Michigan State University; J. J. Stockton, Purdue University; and J. R. Welser, University of Georgia, representing the A.A.V.M.C. This committee developed the format, specified the general topics and selected the site for the Fifth Symposium. Following the selection of the University of Georgia as the location, a local planning committee composed of Doctors M. E. Adsit, L. M. Crawford, J. W. Harris, B. E. Hooper, R. E. Lewis, J. T. Mercer, D. E. Tyler, and J. R. Welser, chairman, was formed. The local committee further developed and implemented the plans for the Fifth Symposium. Invaluable assistance in carrying out the Fifth Symposium was received from the faculty, staff, and administration of the College of Veterinary Medicine, University of Georgia. Without their help and encouragement, the Fifth Symposium would not have become a reality.

For the people who planned the Fifth Symposium, the response was gratifying in spite of Hurricane Agnes and a pilots' strike. The registered attendance of 325 was more than double the number ever to attend a symposium on veterinary medical education. In addition, the response of the participants in reading their pre-conference materials, attending the general sessions, and participating in the workshops made the symposium a success.

The Fifth Symposium was planned as a minicourse in the design, presentation, and evaluation of learning experiences. The topics of minicourses, multi-media instruction, and mastery learning were featured. The meeting attempted to combine the features of a symposium (dining and free exchange); a conference (presentation by outstanding authorities in the field of education, media, and evaluation); and a workshop (individual participation and contribution). Based on this, it was nicknamed "Tricom" by some.

The primary purpose of the Symposium was to assist the veterinary medical educator in becoming a more effective and efficient teacher. Specific objectives were included in the program, and upon pre-registration the participants were sent pre-conference reading materials. The participants were pre-tested on the readings utilizing Trainer Tester cards donated by Van Valkenburgh, Nooger, and Neville. During the Symposium, each participant filled a notebook with copies of the formal presentations, commercial literature, worksheets, and copies of the produced minicourses. A post-symposium test based on

pre-stated objectives was also administered to the participants utilizing the Trainer Tester cards. In addition, the participants also filled out pre-symposium and post-symposium opinion questionnaires. A part of the post-symposium questionnaire has been included in the Appendix.

The Symposium started with an overview of the challenges that face veterinary medical education in Dr. Luther Terry's and W. W. Armistead's presentations. Drs. Postlethwait's, Brown's, Allen's, and Mager's presentations defined minicourses, pointed out their application, and provided the detailed instruction on how to make up a minicourse and write performance objectives. Following these presentations, the participants gathered in small work groups where they chose a minicourse topic and wrote performance objectives for their chosen topic. After appropriate critique and feedback, the particpants attended a presentation on media selection by Dr. Millard and visited media displays provided by veterinary medical educators from all of the colleges of veterinary medicine. The participants were then provided a review of the field of instructional evaluation along with future trends by Dr. Hedges. After presentations directed at different methods of evaluations by Drs. Smith, Gardner, and Block, the participants met in their work groups to structure a pre-test and post-test for their minicourse.

The Wednesday morning session was devoted to a discussion of future trends in education and the educator's role in the affective domain. The presentations centered around the subjects of accountability (Dr. Lessinger), career planning (Dr. Owens), and credits and degrees (Dr. Harris). Concluding the Symposium, T. H. Ham's presentation of "Prospective and Retrospective Views of Medical Education" stimulated the participants and provided ideas for the future.

The spin-off and follow-up to the Fifth Symposium has indeed been gratifying, with 70 percent of the schools of veterinary medicine holding post-symposium sessions in the form of programs, discussion seminars, or circulating presentations along with summary statements. Three schools re-created the Fifth Symposium for their faculties. In these cases, faculty summarized the speeches that were delivered at the Fifth Symposium, and individuals who attended served as discussion leaders.

It is difficult to express appreciation to all who worked and contributed so much to the Fifth Symposium; however, without the support of the faculty and the untiring work of the local committee, it would never have been as successful. Ultimately the credit goes to the participants who came, were enthusiastic, and worked hard at the Symposium. Hopefully the effect of the Fifth Symposium will not end with the publication of these proceedings.

J. R. Welser
Editor

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WELCOME REMARKS

FIFTH SYMPOSIUM ON VETERINARY MEDICAL EDUCATION

R. B. Talbot

Welcome:

It is certainly my pleasure to welcome all of you as participants in this Conference on Veterinary Medical Education.

The theme of this conference is one I am vitally interested in and I want to congratulate you on choosing to participate in it.

Let me for a moment then tell you as words of welcome a few things about the University and the College of Veterinary Medicine.

1. Georgia was the first state to charter a state supported university. In 1784, the General Assembly set aside 40,000 acres of land to endow a college and in 1785, the University of Georgia was incorporated by an act of the General Assembly.

2. The University was actually established in 1801, when a committee selected the present land site. The first class was graduated in 1804.

3. The curriculum of traditional classical studies was broadened in 1843, to include courses in law and again in 1872, when federal funds became available for agriculture courses.

4. Today the University is composed of 13 schools and colleges plus several auxiliary divisions such as the Center for Continuing Education, in which we are meeting today.

5. In 1931, the General Assembly of the state placed all state supported institutions of higher education, including the University, in one organization known as the University System of Georgia. The System is governed by a single Board of Regents with one executive officer, the Chancellor.

6. The University is a dynamic multifacited institution today fulfilling instructional, research, and service responsibilities. There are approximately 18,000 full-time resident students enrolled and 1,900 faculty members.

The present College of Veterinary Medicine was organized in 1946, although it was preceded at the University by a degree program in Veterinary Medicine from 1918 to 1933.

The College has experienced extensive growth and development since 1964. During this period, the faculty has grown from 37 to 101 while the professional student enrollment has been held fairly constant or around 250. Graduate student enrollment, however, has increased from less than 10 to more than 50 graduate students. The College is composed today of seven departments plus two diagnostic laboratories, one in Athens and one at Tifton.

We are extremely proud of our faculty and student body at the College and invite you to spend as much time as possible with them during your stay here.

It is my pleasure to again welcome you to the campus. If I can be of any personal assistance while you are here, I hope you will not hesitate to ask.

NEW HORIZONS FOR VETERINARY MEDICINE

Luther L. Terry, M.D.
Vice President for Medical Affairs, University of Pennsylvania, Philadelphia

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As I discuss the report of the Committee on Veterinary Medical Research and Education with you, I am reminded of the story of two illiterate country boys neither of whom had learned to tell time. One day one of the boys showed up with a bulge in the watch pocket of his trousers and a large chain emerging from the pocket and extending into the side pocket. The second young man on observing these facts and realizing that his friend was unable to tell time inquired, "What have you got on that chain in your pocket?" To which his friend responded, "It is a watch, want to see it?" With that, he withdrew the watch from his pocket and displayed it prominently. The second fellow responded, "Un-huh! What time is it?" The first pushed the watch toward his friend and said, "There it is." The second boy peered at it for a long moment and replied, "Damned if it ain't!"

In referring to our committee's report I am prone to push it at you and say simple, "There it is." However, for fear that you might respond like the second boy, I feel compelled to point out some of the background of the committee and remark about some of the contents of the report.

For many years, I have had a deep professional interest in veterinary medicine. This interest was kindled in part from my many years on the staff of the National Institutes of Health. During this period the importance of laboratory animals in biomedical research was indelibly impressed upon me and the applicability of animal models of importance to mankind was equally impressive. Furthermore, the importance of having specialists in animal medicine as a part of the research team was equally evident.

Then after I became Surgeon General, for the first time in the nation's history we were beginning to convince the Congress of the need for federal assistance in the education and training of our health professionals. This culminated in 1963 with the Congress first enacting the Health Professions Educational Assistant Act. During the planning of this proposed legislation it was necessary for me, the members of my staff, and our consultants to define quite clearly the various categories of the health professions in order that we might make valid recommendations to the Congress. As one analyzed the situation it became quite clear that veterinary medicine was an essential component of our entire biomedical system from the standpoint not only of research, but also in the understanding of many human diseases and the prevention and management of those diseases.

In 1965, when I left the Public Health Service and became Vice President for Medical Affairs at the University of Pennsylvania, I discovered that I inherited a degree of administrative responsibility for a School of Veterinary Medicine as well as School of Medicine, Dental Medicine, Nursing, and Allied Medical Professions. It was at this time that I first had the opportunity to observe closely the education and training of veterinarians and to learn in great depth of the important biomedical research being performed in our veterinary medical schools. I can assure you that I was not disappointed; I was elated to see the contributions of veterinary medicine to human health and welfare. I became a complete convert to the importance of veterinary medicine to human health.

It was in the light of the above experience that I was delighted in 1969 when the officials of the National Academy of Sciences--National Research Council invited me to chair a committee to study the subject and to make recommendations for national guidance in this regard. Furthermore, it was a great assurance to me when I was requested to assist in the selection of the members of the committee. We spent several weeks reviewing the background of potential members and in selecting persons who were not only highly qualified, but who would truly represent the various aspects of veterinary medicine in the field of biomedical research and education. Frankly, I think that I am justified in bragging about the committee because I think we obtained the services of a group of outstanding persons who were willing to dedicate a lot of their personal time to the subject. Each member had a full-time responsibility to his home institution, but each of them was willing to give of his personal time, and many long weekends and holidays were devoted to the study. I am grateful for the contributions of each and every member of the committee.

In speaking of the background of this report I should not fail to mention that the Academy was stimulated to establish this study from a request supported by a grant from the American Veterinary Medical Association. You will note in the report that other organizations, both government and private, also supported the project. During the entire course of our studies, we received strong support from the AVMA, the Association of Veterinary Medical Schools, the Department of Agriculture, the Public Health Service, industry, and many other organizations and individuals. The entire staff of the Academy was cooperative, but we owe special thanks to our full-time staff member, Dr. Samuel Abramson, a veterinarian, and to Dr. Russell Stevens, Secretary of the Division of Biology and Agriculture, NAS. It is impossible to recognize all of our sources of information and advice, but the committee is grateful to each and all of them.

Now that **New Horizons for Veterinary Medicine** has been completed and published, I am concerned for the first time. This concern reminds me of the age-old story of the apartment dweller who, when preparing for bed, heard clearly his upstairs neighbor drop his first shoe on the floor and was unable to sleep for the entire night while awaiting the impact of the second shoe being dropped. Our report has been "dropped" and I am greatly concerned that I have heard little response about its contents. I sincerely hope that today the second shoe will be "dropped" and that we will have a free and open discussion of the report. There must be persons here who have "good" and "bad" things to say about it. I am further appreciative that other members of our committee are present to hear and to share with me in this critical discussion.

I would like to select certain general recommendations from the report and also to mention some of the more specific details:

1. Veterinary medical schools have historically grown-up in the atmosphere of land-grant colleges and the result has been a much closer relationship to agriculture than to human medicine. Over the years veterinary medicine has undergone a series of transitions ranging from services almost entirely limited to diagnosis and treatment of animal diseases during the early days, to the more recent encouragement of veterinarians in an array of medical services relating to agricultural enterprises and food production, industry, companion animals, the public health, research and teaching. In considering this evolution it is quite clear that veterinary medicine should not release its ties to agriculture, but the profession is clearly merging closer to human medicine and this relationship should be strengthened. It is my opinion that a veterinary school which is geographically near and/or has a working relationship to a university medical center is fortunate. Obviously, it is not feasible for most of our veterinary schools located away from medical centers to be moved. But it is possible for those schools to associate themselves more directly with human medicine in their vicinity. Furthermore, the importance of this shared relationship between human and veterinary medicine should be borne in mind by those persons who have a responsible role in the

location of new schools. It is a certainty, in my mind, that those two interrelated professions will need to work more closely in the future.

2. Just as in human medicine, there is the need in veterinary medicine for major revision in our core curriculum and for up-dating many of our teaching methods and techniques. Increasing specialization in veterinary medicine will necessitate some broadening of the core curriculum, but it also makes it mandatory that the veterinary student be given an opportunity for special and intensive experience in a particular field while still in undergraduate professional school. Students entering professional schools today are far better prepared than comparable students of previous years and it is an opportunity and challenge for our educators of today to take advantage of this great asset. It is our responsibility to not force them into the monotony of repeating subject matter but to use this additional time to introduce them to new learning experiences and to give the student an opportunity for special attention to subjects of special individual interest to him.

   I shall not go into a discussion of many of the details of veterinary medical education considered in the report. But I wish to call your attention additionally to improvement in the use of teaching methodology to supplement the time and ability of the good teacher. Self-teaching devices have a real place in professional education, not only to supplement in-school learning, but to give the trainee an experience which can be valuable to his continuing education throughout life.

3. Veterinary medicine has lagged far behind its sister profession in the development of more and better formal post-graduate programs to prepare its members for practice or research. It is startling to realize that with 1240 graduates of our veterinary schools in 1970–71 there were less than 100 formal internships available for their post-graduate training. An even worse condition prevails in relation to residency training leading to exceptional proficiency in the clinical sciences. Since this type of training is less formalized and standardized, it is difficult to give an exact estimate of the number of residency training spots available but in 1969 there were only seven veterinary schools offering residency training programs and there were only 41 residents in training that year.

   Of course, it is recognized that not all post-graduate training of veterinarians is in formal intern or residence training programs and that these experiences are primarily designed for training to practice. There are advanced degree programs leading to a masters or doctors degree in all but one of our veterinary schools. During the 1969–70 academic year, 312 veterinarians were enrolled in Ph.D. programs and 321 were in masters degree programs. In addition, veterinarians get advanced degree training in departments of veterinary science, medical schools, and basic sciences departments of universities. Non-degree training is available in many government laboratories and at private research laboratories, but these programs are commonly informal in content and are frequently tailored to the service needs of the particular organization.

   To my mind, one of the most glaring deficiencies in our veterinary educational and training activities is in the area of post-graduate training. We need more and better internships, residency, post-graduate degree, non-degree, and specialty training programs. This matter is so urgent that all of our institutions with responsibilities in this area should address themselves to this great need. Furthermore, there should be a combined effort in this direction which should be led by the AAVMC and the AVMA. Uniformity and acceptable standards should be of paramount interest.

4. Professionals generally are becoming increasingly aware of the need to continue

their education beyond the period devoted to earning an academic degree. The rapid pace of scientific advance demands that a professional person pursue a program of "continuing education" if he is to be proficient in his profession. Since 1962 the AVMA has given leadership in stimulating the development of courses for this purpose and has provided information on the availability and content of specific programs. This is a step in the right direction but there is much more to be done. There should be more collaboration and discussion of responsibility between the colleges of veterinary medicine and the professional associations to facilitate the evaluation of more effective, expanded programs. Our committee has suggested how these objectives might be obtained. In addition, the committee has specifically recommended that the AVMA Council on Education should extend its efforts as follows:

> "A program to structure appropriate continuing education courses should be developed. Certain lectures and demonstrations serve best, perhaps, without extensive involvement of a national association, but many courses can be selected and organized for sequential treatment or directed toward specific goals on a national, integrated, and coordinated basis.
>
> "A system of evaluation of the quality and effect of continuing education programs should be developed."

I commend this advice for your consideration and action.

5. One of the committee's very prominent concerns was in relation to the training and utilization of paramedical personnel. As in human medicine, there is a growing awareness of the deficiencies in this regard and an appreciation that this is one of the best ways by which we may more rapidly and effectively increase the availability of quality veterinary medical services.

When one reviews the available information on the subject, it is startling to learn of the very low technical-to-professional staff ratio in our veterinary schools. And yet, here is the greatest opportunity, not only to train paramedical personnel, but also to "extend the arms" of our teaching staff and train the young professional to use such personnel effectively. For example, it has been clearly shown in dentistry that the most opportune time to train a professional in the use of auxiliaries is during his formal education, both undergraduate and immediately thereafter. Furthermore, there are no areas related to veterinary medicine which are more qualified to train paramedical personnel than our professional schools. A veterinary school's involvement in such activities need not be confined to its immediate premises but can be effectively extended by affiliated programs with private practice groups and other institutions utilizing veterinary medical services.

The committee has pointed out a particular area in which technicians could be used more effectively and thus permit the veterinarian more time for responsibilities which are truly of a professional nature——lay meat inspectors. It has pointed out that at least one state (New York) requires that lay meat inspectors have an associate degree after two years of junior college training in a food, meat, and dairy technology program. The committee felt that this effort deserved commendation, but also recognized that the effectiveness of such inspectors depended upon the quality of the training program plus the adequacy of professional supervision thereafter. Junior colleges must have professional participation in such teaching if it is to be meaningful and effective.

General medical technologists can be trained to work as a part of a veterinarian-led team in much the same way as when serving as a part of a team in human medicine. Because the role of animal technicians is still evolving, it was not felt that any fixed

curriculum or period of training can be recommended at this time. However, graduates of college-level programs should be encouraged to organize themselves so that they can develop a recognized certifying and accrediting program and, ultimately, standardize course curricula with established minimal training requirements.

6. There are many other specific recommendations of the committee, but in closing I would like to call your attention to one other area to which considerable attention was devoted but with which it was not content with the information which evolved. I am referring to the role of companion animals in contributing to human health and welfare from the emotional standpoint. I am not referring to anything as utilitarian as a riding horse, hunting dog, or a seeing-eye dog.

There is a growing belief among psychiatrists and psychologists that companion animals fulfill important emotional needs and hence contribute significantly to human well-being. All of us have been impressed on repeated occasions by the importance of a pet to the elderly, the lonely, and to the mentally ill or mentally retarded person. The tragedy of the illness or death of such a pet can be literally devastating to many such individuals. Yet, the role played by these animals has not been adequately studied. Consequently, we sometimes find ourselves in an uncomfortable position to respond when a legislator complains, "Why should public funds be used to help train a person who is to become a pet doctor?" I submit to you that such an attitude is not justified, and we as a nation are devoting an increasing amount of professional veterinary resources to the care of household pets--a trend which is likely to continue. I urge the members of the veterinary and medical professions to pay more attention to this subject and to institute collaborative studies which will give us more objective information. Unless we can get more reliable information about the importance of pets to the mental health of people and to psychotherapy, a serious threat will continue to hang over the heads of those of us who are proponents of public assistance to veterinary research and education similar to that of human medicine.

Probably the most controversial issue dealt with in our report is the number of veterinarians needed in the future in various categories of practice, as well as, the total needs for all types of practice. I am sure that some may disagree with our conclusions, but I would point out that the committee devoted a great deal of attention to this subject. Every known source which might be helpful was consulted. Furthermore, in Appendix H we have described in detail how we arrived at those conclusions. I commend your attention to this section for it is a matter of vital interest not only to veterinarians but to the entire nation. Unfortunately, our most optimistic predictions will result in a significant deficiency in the number of veterinarians by 1980. This shortage can be partially atoned for by the development of more effective utilization of the existing personnel, but we must continue to insist upon greater support for veterinary medical research and education at both the state and national level.

All of us who served on the committee hope and trust that our efforts will give leadership for advancement in the entire field of veterinary medicine.

DISCUSSION

The Committee of the National Academy of Sciences "Report on Veterinary Medical Research and Education"

Panel

L. L. Terry
W. H. Eyestone*

Moderator

R. B. Talbot

Q. Was the effect of a decrease in the population explosion on the projected need for Veterinarians considered?

A. (Dr. Eyestone): Yes, that point was considered very seriously. The population reduction projected for the next ten years might reduce the need for professional personnel. As Dr. Terry noted in his report, some professionals are being released from the lay-type activities in meat inspection by lay help. In a practice situation we could probably reduce the need for professional people with lay help.

(Dr. Terry): Most of you are aware of the change that is going on in human medicine today in terms of health manpower personnel in the various categories. One of the very popular modes at the moment is the physician assistant, a person less well-trained than a physician to assist in the delivery of medical care. Some of these programs encompass a few months training before the person is put in the field under the supervision of a physician to others which area a full four-year baccalaureate program. Frankly, human medicine is a confused mess in this regard. Part of the confusion is due to the realization that many things that physicians are doing could be performed by trained technical supportive personnel. If we are going to get better distribution of medical care, we are going to have to utilize every aspect in trying to support the physician and extend his expertise to cover more areas. I think the same situation is facing veterinary medicine today, though it has not quite crystallized or precipitated yet. This is one of the areas in which veterinary medical schools need to give clearer and stronger leadership in order that the type of personnel, their proper training, and their utilization under professional supervision be defined.

Q. On what basis was the additional need for Veterinarians projected since they vary from

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* Chairman, Department of Pathology, School of Veterinary Medicine, University of Missouri, Columbia, Missouri.

the projected need as published by the Bureau of Health Manpower?

A. (Dr. Eyestone): The estimates from the Health Manpower Act are extrapolations of growth in the past, whereas the estimates in this report were based more on professional estimates of what might happen to certain segments of the profession and adding it all together to come up with a number. History has shown that the increase in the numbers of veterinarians and changes in their activities does relate to population growth even though their distribution does not relate to centers of population. Veterinarians still largely relate to the concentration of food animals in the country. Even though we tend to follow population growth, there are other factors to consider. We don't totally relate to population growth. New areas are becoming involved, environments, etc. that Veterinarians are becoming more and more involved and interested in. There has been a reduction in the need for veterinarians in the food animal area by virtue of the mass production methods that are being used. This has been during a population growth era and from what we've discovered does not lead to a drop in the need for veterinarians. Lack of population growth doesn't mean necessarily that we've stopped growing. Contrary to the public opinion, we will still have a gradual increase in the population. I believe the figures which you see in this report are related to our expected population growth, not our growth due to other areas.

Q. Where do you feel lay help or Veterinary technicians should be trained?

A. (Dr. Eyestone): Their training should be related largely to the training in professional schools where professional students would have the opportunity to observe their use and training close at hand, where students can become accustomed to using auxiliaries. Also, this is the best place for this type of training. In the manpower law it states this must be the place of their training in the case of medicine.

(Dr. Terry): I have mentioned in my remarks that certainly not all of this training must be restricted to veterinary medical schools. On the other hand, I do feel that our veterinary medical schools are the ideal locus for continuing development and improvement. In this regard, I think there is great incentive both to the trainer and to the trainee if carried out properly. In referring to the primary and important load of the veterinary school in the training of technical people, I didn't mean to infer at all that this should be the only point of training. In the first place, I think standards and programs for training of these people should be developed. In some veterinary schools, faculty may be decreased by 10 or 20 percent if scuff work jobs were left to technical help rather than to professional persons who shouldn't be doing them anyway. The same thing is true in private practice. Whether 5, 10, or 20 percent or whatever it is, there is considerable segment of work performed by a veterinarian, both teachers in our school as well as practicing veterinarians in the field, which should not be done by professional people. It is up to us to divise methods and programs for the training of people to do these jobs. Serving as a technician is a perfectly honorable profession, but at the same time does not require the training that is required of a professional person such as a veterinarian. I would urge that much more be done in this direction and we cannot only improve the availability of veterinary medical care but at the same time we can do a lot better job of medical practice.

Many groups and individual veterinarians will be training technicians for particular roles in their own office or practice area. This is to be expected. At the same time I would point out to you that many well-trained technical people may be picked up from the human medical field: radiological technicians and

laboratory technicians and other people who are trained in our hospital and medical centers and which can be valuable additions to veterinary practice and training.

Q. What type of quality control is being placed on technical training schools?

A. (Dr. Eyestone): In some cases the state veterinary association and the college are doing some supervision over some of the activities involved in the Associate of Arts degree. Certainly the junior colleges, and other commercial training programs that have sprung up have been having problems in terms of agreement on what these people really ought to have as training and supervision of graduates. And they will have problems until we get to the point of state licensure. I don't see how we can fully control the situation. However, it seems to me that in the state boards of veterinary medical examiners and in states where a veterinary college exists there should be reasonably close supervision over the kinds of curricula, teaching, and preparations for an associate of arts degree. Certainly there are types of training that can be done nicely in such a setting. But when one considers a veterinary technician, by definition, analogous to the physician assistant, that kind of person really ought to be trained in a veterinary college clinical setting.

Q. I can cite several examples where graduate technician training programs are assuming professional duties. How can this be prevented?

A. (Dr. Terry): I fear, I literally fear, some of the technical and semi-professional people that are being turned out by some of these schools without acequate supervision, professional leadership, training, guidance, and instruction. To my mind the biomedical area must do everything it can to assist and stimulate the development of adequate training programs so that we will not have turned out an albatross to hang around someone's neck. I think we're probably in for some rough times in this regard, more so in the human medicine technical area than in veterinary medicine.

Practically every community in this country wants a community college. One of the big fields in many of the community colleges is not the liberal arts associate degree but subprofessional technical training, especially in the biomedical area. I think all of us are considerably concerned about the availability of quality teachers, guidance, and instruction for the people who are being trained in these areas. I think it's important for veterinary medicine to get its foot in the door so to speak, and to exert some leadership in helping to establish the nature, quality, and minimal requirements of the training of the subprofessional technical people which will serve us and society.

Q. In a recent report of the Pan American Health Organization, it was recommended that the technical assistants to veterinarians be called animal health assistants and their training be carried out by colleges of agriculture. Can you comment?

A. (Dr. Terry): I'm wondering if, as Linus in the comic strip, veterinary medicine is losing its security blanket. In talking about the training of technical, paramedical, and subprofessional personnel which are to be used by veterinary medicine: if the veterinarian is afraid to have his name associated with them and wants to call them animal health care assistants rather than veterinary assistants, and furthermore, if he doesn't allow them to put a foot in his school, I fail to see the point! To me, clearly, the veterinary medical profession must give leadership in this direction and I would hope that people here are in the best position to give that leadership. I'm also concerned as to whether the veterinary medical profession generally, and our veterinary medical schools specifically, are

willing to step into this area and give some real meaningful leadership.

(Dr. Eyestone): I think we gave a great deal of consideration to this point of view and attempted to be totally objective about measuring anything but effectiveness of the personnel involved. The only place to do this kind of training was in, around or under the supervision of colleges of veterinary medicine; whether you call them veterinary technicians, or what have you. Although it seems to me these comments are more often generated by the practitioners in our group than by those of us who are not in practice, people who had used well trained assistants in their practices seemed to firmly agree about the issues that we have mentioned and that these assistants should be trained by veterinary colleges. As Dean Tietz mentioned, perhaps this could be done at some school in Denver, Colorado under the supervision of the College of Veterinary Medicine, with the students eventually coming to the clinic at the College of Veterinary Medicine for final training before being released to practitioners. As is strongly reflected in the report, not only would the technicians who evolved from this program be working in the proper environment, but the senior students would learn how to use them in their future practice.

Q. Will the participant pay for continuing education, or can we look for public funds to provide re-training and continuing education programs?

A. (Dr. Terry): Probably the best answer that I could give would be based on our experience in human medicine in continuing education in medical schools and the role of public funds in relation to this. I do not feel we have continuing education as well organized in human medicine as we should have, although in recent years we have developed in terms of quality and areas covered. Generally speaking, public funds have been made available for continuing education in human medical areas only to institutions and not to support the expenses of the person attending. In addition, the support to the institutions has not usually been enough to avoid them requiring tuition. There is a general tedency on the part of our legislators to feel that in contrast to a student who is going through school, a practitioner, whether he is working for an industrial firm, the Federal Government, or a private practice, is an earner. Therefore, he should pay at least in part, if not totally, for his upkeep, refurbishment, and training in his chosen field of continuing education. Thus, I imagine that some of our schools will be given assitance in a limited form from public funds but, in general, I think that most of these programs will need to be conceptualized on the basis that participants will pay a large part of the cost of instruction. Universities and other institutions are obviously going to underwrite some of the basic expenses, and professional organizations like the A.V.M.A. should also contribute. However, a large part of it will have to be carried by the individual professional who is getting the continuing education and, after all, it is tax deductible.

Q. What is the role and importance of companion animals in our society and do we have data to support their importance?

A. (Dr. Terry): The committee was greatly disappointed by the amount of really objective information from any source on the subject. At the same time everyone of us as individuals, whether we are proficient veterinarians, medical scientists, or other professionals working in the area, are convinced of the great importance of companion animals, particularly pets in relation to human health and welfare. I think we need much more study and documentation, of well conceived studies that are done by capable psychiatrists, psychologists, animal behaviorists, and veterinarians. These studies should be done

in a collaborative way, so that much more evidence can be derived in this area. I think that any physician who has taken care of patients such as the elderly, the lonely, the mentally ill, or mentally retarded, cannot but help having recognized the importance animals and pets play in the lives of these people. But we just do not have enough documented information. Time and time again I have been clobbered by some legislator who says, "Why should public funds be used to educate somebody who is going to become a pet doctor?," which to my mind is a completely idotic statement and unappreciative of the importance of pets in relation to human life and welfare. Yet somehow or another we have to obtain more and better information on the subject in order to overcome some of these prejudices.

(Dr. Talbot): Our time precludes any more questions. I am sure Dr. Terry and Dr. Eyestone would be glad to answer any additional inquiries on an individual basis. I would like to thank Drs. Terry and Eyestone for coming and adding so much to our Symposium.

THE WINDS OF CHANGE

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Introduction

Let me begin by explaining that the title, "The Winds of Change," was assigned to me; I did not select it. But I happily accepted it because it seemed so appropriate. When one thinks of a dean, one just naturally thinks of wind.

Seriously, the title is appropriate to the theme of the symposium and I am honored to have been asked to make this contribution to the program. As I understand it, my assignment is to interpret what changes are "in the wind" for veterinary medical education. It is an important assignment and one which I do not feel unusually qualified to carry out. But I shall give it a try, with confidence that what I overlook will be filled in by others at this meeting.

That there are significant changes in the wind is indisputable. The real questions are (1) the nature of these changes and (2) their implications for veterinary medical education in the decade ahead.

In discussing these matters I shall try merely to help set the mood and stage for this symposium. If by chance I should have any impact beyond that, I shall be surprised but grateful!

What Is in the Wind?

Veterinary medical education in the next decade will be affected profoundly by many of the issues impinging upon higher education as a whole. Of these the most important probably is funding. Many of us in veterinary medical education have not yet seen––or at least have not yet accepted––the full implication of national trends in financing higher education.

One thing is certain. We shall not see again for a while a period of sustained growth such as we experienced in the 1960's. There are several reasons. The American public is showing increasing resistance to mounting taxes. The mushrooming demands of social reform programs are producing greater competition for the tax dollars at every level of government. And, what is of great potential significance, the taxpaying public and their legislators are becoming increasingly disenchanted with higher education in general. They appear to have been "turned off" by radical student behavior, by even higher admission standards, by increasingly strident faculty salary demands and, most recently, by the shortage of jobs for new college graduates.

Also in the wind is a growing interest in innovation and experimentation in veterinary medical curriculums and teaching methods. Part of this is self-generated among progressive faculty members. But much of it has been triggered by other stimulants such as:

Austere state budgets which force efficiencies.

Availability of federal funds through programs which put a premium on increased enrollment.

The pioneering example of certain innovative human medical schools.

A growing body of literature on medical education.

The rapid recent development of new technology for teaching and evaluation.

The changing character of the veterinary medical profession.

Student demands for more flexibility, objectivity, and relevance in the curriculum.

What Are the Implications?

When all factors are considered it seems clear that in the 1970's we in veterinary medical education will have to take a closer, more objective look at ourselves. We shall have to become more productive, which is to say more effective and more efficient.

New programs will have to be funded mostly through reallocation of resources rather than with additional new funds. Program improvement will have to be achieved mainly by increasing productivity rather than by adding people and dollars.

That is not all bad. Nor is it entirely illogical. In fact, it seems to me extraordinarily naive to expect that those paying the bill (taxpayers) will happily support universities in the style to which they have become accustomed simply because we think they should. Economists agree that it is difficult, if not impossible, to separate price from value. And it is the one who picks up the tab (taxpayer)——not the vendor (professor)——who must feel that the product is worth the cost.

Of course it would be unfair and inaccurate to claim that we are being victimized by circumstances beyond our control. Much of our current dilemma is of our own making.

The federal government has responded with funds for increased enrollment because we have insisted for years (apparently very convincingly) that there is a great and growing shortage of veterinarians.

We appear to be losing the support of some rural taxpayers because we are not producing enough veterinarians who are willing to enter farm practice and who can function effectively in today's highly businesslike livestock industry.

Urban clients (who also are taxpayers) are complaining about the lack of emergency service on evenings and weekends.

Veterinary students are becoming increasingly critical of their education partly, if not largely, because they feel that curriculum improvement has lagged behind public need.

Legislators are becoming disenchanted with medical education, including veterinary medical education, because of what they interpret as its excessively high cost and low accountability. Whether their view is accurate or not, the facts are that they believe it and we have done little to change their belief.

The colleges also are being accused of graduating veterinarians who are increasingly mercenary. Both clients and older practitioners complain that new graduates lack the commitment to service that their predecessors had; that they are more interested in salary, hours, and fringe benefits than in taking care of patients. This of course is an old allegation. Whether it is any more valid now than in earlier years is open to question. But if it is true, there is great danger in its implications for the future of veterinary medical practice. Perhaps it would be revealing to have a look at what has happened in human medicine where this development appears to be further advanced.

During the past two or three decades there has been a striking change in the perception of physicians by their patients and, as a result, by the public at large. The image of the physician has changed from that of friend and counselor to that of scientific businessman. This change has been promoted by the growing impersonality of the doctor-patient relationship. The family doctor seems to be disappearing. Very few physicians will make house calls; even an illness developing suddenly at home now is referred to the hospital emergency room where it is treated by a harried, youthful, total stranger.

The remarkable growth of specialization also has contributed powerfully to the change of public

attitude toward physicians. The specialist of course is more competent. But because the specialist's patient usually is referred, hence a temporary patient, and because of the specialist's interest in a narrow field of medicine, he is likely to seem less genuinely concerned for the patient as a whole person.

One serious consequence of the growing impersonality of human medical practice is the enormous increase both in the number of malpractice suits and in the dollar values of damages awarded. Malpractice insurance rates for physicians are skyrocketing. It seems that a disgruntled patient is more likely to sue a scientific businessman than a friend and counselor.

The lessons for veterinary medicine to be drawn from these developments in human medicine should be fairly obvious. The problem may be one to be grappled with primarily by organized veterinary medicine. But the role and influence of veterinary medical educators in shaping the attitudes of, and clarifying the moral issues for, future practitioners certainly cannot be overemphasized.

Much of what we are doing in veterinary medicine was borrowed from human medicine. Part of it has suffered in the translation and some of it was inappropriate to veterinary medicine in the first place. But, on the whole, the example of human medicine has served us well in our rapid transition from a rustic art to a modern medical science.

Given the sophistication of veterinary medicine today, there certainly is no need for us to ape human medicine. But it seems wise for us to recognize the obvious similarities of the two professions and to try to profit from the knowledge that, historically, many trends in human medicine have preceded similar trends in veterinary medicine.

What Should We Do?

Even if I knew exactly what to do, it would be inappropriate to try to be too specific in a presentation such as this. But here, for whatever it may be worth, is a partial list of **trends**——some actual, some only wishful——which we probably should be supporting or promoting in veterinary medical education. Most of these trends represent not the abandonment of one position in favor of another but, rather, simply the shifting of emphasis.

From the "castle-with-moat" philosophy on campus **toward** a more open, outward look to other parts of the university and to off-campus constituencies.

From a scientific inferiority complex **toward** confidence and par feelings about other medical sciences and scientists.

From emphasis on reversing disease **toward** more attention to preserving health.

From traditional departmental alignments and course sequences **toward** more functional combinations and sequences.

From spasmodic, revolutionary curriculum revision **toward** continuous evaluation and evolutionary change.

From simply adding to the curriculum (by lengthening or packing) **toward** shortening (by culling and condensing).

From emphasis on teaching **toward** emphasis on learning.

From heavy dependence on the lecture **toward** more programming.

From the empirical approach to education **toward** research-based teaching techniques, curriculum development, and evaluation methods.

From the "generalist" approach to clinical training **toward** options for accommodating differences in student aptitudes, interests, and career objectives.

From traditional fact-testing of students **toward** evaluation of student performance.

From forcing the student into rote memorization **toward** development of student abilities in deduction and problem solving.

From small enrollments **toward** larger enrollments. (All trends are not either desirable or undesirable. Some are merely inevitable, hence should be dealt with constructively.)

From the chauvinistic, "what's-best-for-the profession" philosophy **toward** a greater concern for the wishes and needs of the consumer (client).

From a preoccupation with techniques **toward** more awareness of principles.

From perceiving the D.V.M. curriculum as the only preparation required for a career in veterinary medicine **toward** acceptance of the necessity for continuous, lifelong education.

The transition of veterinary clinical education has been particularly interesting. Throughout the first half ot his century the standards of veterinary medical and surgical practice were set by private practitioners. In the 1950's the veterinary college clinics began a very rapid growth in competence which has placed them in positions of leadership. The reasons are obvious: increased dollar support, improved facilities, the development of specialization, and the growth of clinical research.

In all this we should not discount the influence of increased student enrollment, which has justified larger budgets and larger faculties, thereby providing greater breadth and depth of competence and more time for research and self improvement. While many are inclined to view increasing enrollments as exerting an undesirable influence on the quality of education, the reverse is more likely to be true.

Unfortunately, while the scientific stature of veterinary medicine has been increasing at a gratifying rate, improvement in veterinary medical education has been disappointing. Most curriculum change has been only cosmetic surgery--a rearrangement of features to give the appearance of youth. Underneath has remained the same, aging educational organism.

Of course nobody ever is completely happy with the product of a curriculum committee--least of all the most progressive members of the faculty. Committees operate on the principle of compromise. Committee recommendations therefore seldom represent a significant departure from the status quo because the most innovative suggestions of individual members are bargained away in the process of committee debate. As Thomas Carlyle said, "Every new opinion, at its starting, is precisely in a minority of one." Our colleges of veterinary medicine would have much more interesting curriculums if we could devise some means for providing safe conduct of a new idea through the hostile wilderness of modern university bureaucracy.

As veterinarians we are relatively new at the business of education. Most of us have a quite superficial knowledge of the literature of educational research and our educational experiments tend to be highly empirical. Furthermore, those of us who are most interested in improving teaching and learning also are likely to be the busiest with other tasks. As a result, it becomes easier to think it up than to look it up and we tend to keep rediscovering the wheel. Still we are making progress and our ignorances and inefficiencies gradually are being overcome.

A number of blind spots persist in our view of improved veterinary medical education. For example, we have not taken advantage of one of the richest teaching resources in the whole system--the students themselves. It should be possible to design the curriculum, schedule classes, and deploy personnel in such a way as to make maximal use of this virtually untapped teaching resource.

We have learned already that an autotutorial carrel designed for two students is more effective than two carrels designed for one student each. This is because of the reinforcing (teaching) influence each student has on the other. To carry this further, upper level students should be able to help teach lower level students, to the enormous benefit of all concerned. Faculty time now spent in presenting introductory, elementary, or orientative material would become available for student counseling and evaluation. At least two other benefits would accrue to students who are involved in teaching. The person who is required to teach is thereby stimulated to learn more

accurately. Moreover, through teaching one practices communication. And poor communication is perhaps the greatest single deficiency of professional individuals and organizations.

There is another long-standing blind spot in our vision of better veterinary medical education. I refer to our contradictory attitude toward agriculture. We tell our students that in large animal practice they must understand, support, and work closely with livestock producers. But we do not often behave that way toward the animal science departments on campus. We acknowledge the importance of genetics, nutrition, and husbandry to livestock health, yet we have only minimal interaction with those agriculturists on campus who have the greatest expertise in these subjects. It is ironic that, with our new found interest in collaboration with human medicine, we are developing reciprocal agreements of a type we never considered with agriculture. In view of the changing character of animal agriculture, we need the help of animal scientists in the training of our students, in the design of our clinical research projects, and perhaps even in the continuing education of our clinical faculties.

Conclusion

When one considers what needs to be done in order to bring our educational practices up to our aspirations, the task seems overwhelming. To begin with, we are not certain about what needs to be done. Beyond that, implementing such changes as we might agree upon is an awesome task.

As Machiavelli pointed out, ". . . there is nothing more difficult to carry out, nor more doubtful of success, . . . than to initiate a new order of things, for the reformer has enemies in all of those who profit by the old order, and only lukewarm defenders in all of those who would profit by the new."

Paradoxically, in these days when change has become more fashionable, it has become at the same time more difficult to bring about because of the enormous proliferation of committees, councils, and democratic procedural channels.

The more conservative among us are likely to decry "change for change's sake" and to caution against "extremes." But there is much of Gertrude Stein's contention that "a difference, to **be** a difference, must **make** a difference." And to really make a difference, changes must be extensive--extensive enough to alarm conservatives and to discomfort those who have settled amiably into the status quo.

It seems to me that the danger of our "going too far" in educational reform is remote, indeed. In the first place, the university bureaucracy would not permit it. A truly radical proposal would not likely survive the nibblings and gnawings of democratically selected committees and councils. And if by chance it were to make it through in recognizable form, the delay would have been such that it no longer would seem radical by the time it emerged.

So my admonition is to promote intelligent change, to innovate, to experiment, and to not worry about "going too far." If you are not convinced that our democratic process will keep you from going too far, perhaps you can find comfort in the knowledge that no change has to be a life sentence. If it doesn't work it can be changed again.

It should reassure you also to realize that veterinary students are remarkably durable, adaptable, and enterprising. Having survived scholastic screenings at the high school, university, and professional college levels, they are entirely capable of surviving without permanent scarring an occasional educational faux pas. Besides, we in education habitually credit ourselves with having more influence on students than we really have. In the final analysis, the individual student decides what he will learn. All that the best of us can do is to help him make the correct choices--and we are not always right.

I hope that my remarks will not be considered anti-intellectual or anti-academic. I consider them to be exactly the opposite. It is the penchant for probing new frontiers, for synthesizing new knowledge out of old, for testing hypotheses, that characterizes the truly intellectual scientist and distinguishes him from the theoretical philospher.

Trying must be part of the intellectual process in any applied science such as veterinary medical education. The theories of the Greek philosopher, Empedocles, although erroneous, were accepted as truths for 2,000 years because they were not tested.

So I am optimistic about our chances for bringing about significant reform in veterinary medical education. And I am particularly excited about the potential influence of this symposium on teaching and learning in our colleges of veterinary medicine.

VETERINARY MEDICAL EDUCATION AND THE UNIVERSITY

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You have asked me to address myself to the general subject of "Veterinary Medical Education and the University." Therefore, I shall share with you some of my thoughts on the shifting trends and changing directions in higher education and their possible implications for veterinary medical education.

First, I shall comment briefly on the history and accomplishments, the benefits and the needs of veterinary medical education in the southern region.

The Southern Regional Education Board's program for assisting in providing regional services in veterinary medical education has grown and prospered for more than two decades. As you know, this program is based on contracts through SREB between states which have schools of veterinary medicine and states which do not. During the first 21 years of the program--1949 through 1970--nearly 8,000 spaces were provided by five existing schools for students from other states.

The benefits from the program are obvious. The schools themselves have received more than $11 million from the contracts. The program has been a pacesetter in exemplifying the desirability and the fruitfulness of regional cooperation in providing highly trained professional personnel. The program has provided veterinary medical education for students who otherwise would not have had such opportunity. The people of the South and the nation are the ultimate beneficiaries. The program also has assisted schools of veterinary medicine in maintaining high admission standards by giving them a wider choice of applicants than one state could provide.

While the program has developed rapidly and successfully, the needs for veterinary medical programs and facilities have grown even more rapidly and thus, at this point in time, demand urgent attention.

In recent years, the size of pre-veterinary classes has increased significantly. In almost every SREB state, there are increasing numbers of well qualified candidates seeking admission to veterinary schools under limited state quotas. Every contracting SREB state desires additional spaces. Students are seeking enrollment in out-of-the-region schools because of the lack of spaces in the South.

It is hazardous to predict the extent of future demands for professional and technical personnel in any field. However, there is no doubt that the needs for all kinds of medical and para-medical personnel will continue to increase at a rapid pace. The problem of expanding the size, scope and quality of our health education and delivery systems is one of the crucial challenges of today. It arises both from the growing demands and the rapidly increasing costs of health education and delivery. Veterinary medicine, with its impact on human, as well as animal health, is an integral and important part of the health delivery system. There also is an emerging and crucial role for veterinary medicine in ecology, marine and space biology, oceanography and other areas.

Therefore, in view of limited SREB spaces--the expanding role of veterinary medical education--and the projected needs of the future--it is obvious that the SREB program should be augmented. To achieve this objective, the SREB special committee on veterinary

medicine, which I had the privilege of chairing, recommended to the board that three of the five existing veterinary schools in the South be expanded and that two new schools be established, including the one now under construction at Louisiana State University. These steps, the committee feels, would meet current demands. In view of federal assistance in financing the expansion and construction of these schools, the committee believes they should be committed fully to the concept of regional service.

While expansion certainly is one of the crucial needs of veterinary medical education, it does not stand alone. Veterinary education, like other professional programs, is subject to the changing conditions affecting higher education and society in general.

Those of you who have had the opportunity of reading the April 1 issue of your Association Journal were doubtless impressed by Dr. George C. Poppensiek's article entitled, "The Impact of University Reform on Veterinary Medical Education." He makes the point that the academic programs of schools of veterinary medicine seem to have been less affected by the social and ethical revolutions of the 1960's than have those of the non-professional schools. However, he concludes that veterinary students are no less impatient with the need for changes in the adequacy and relevancy of the instructional programs. He refers also to the needs for curricular revision to reflect the changing needs of the society the profession serves.

In my view, all higher education stands at a crossroads today.

During the past quarter of a century, universities and colleges have been concerned in large measure with expansion to care for the influx of students following World War II and the Korean War. They also have been involved in a vast expansion of research and public service programs to cope with national priorities resulting from the advent of the Space Age.

Enrollment increases are due largely to the population explosion and to the ever growing percentage of high school graduates electing to attend college. The mushrooming of research and public service activities is correlated with the geometric progression of science and technology associated with the Space Age.

Universities are still faced with the challenges of responding to multiplying demands for expanded programs of education, research, and public service. However, other external and internal pressures for improvement of higher education arise today from changes in society. The people of our nation, and indeed the world, are in the process of reassessing values, shifting emphases and striking out in new directions. They are concerned about the impact of new knowledge and new ideas. They are seeking solutions to such urgent problems as the need for international peace, racial unrest, desecration and pollution of our environment. They are concerned about poverty in the midst of affluence, and the scientific and technological upheaval that has altered the substance and quality of our lives. Philosophers and social scientists for years have been warning us that we are not giving adequate attention to the social and economic problems of our times and that technological developments have outrun our political and social processes. Thus, higher education, it would seem, has no choice but to give attention to these changing conditions and shifting priorities.

In a commencement address at the University of Tennessee recently, SREB President Win Godwin has spoken eloquently to this general question and I quote: "Higher education today faces new social, political and economic realities which demand academic reforms, not just more academics; efficiency, not just growth; more help in applying knowledge to critical public problems, not just more research . . . We need more flexibility in the teaching system, more points of entrance, transfer and exit, and more opportunity for work and experimental learning."

It is generally agreed that higher education must become more introspective. During the period of explosive expansion, high education has not given adequate attention to internal evaluation and restructuring.

Therefore, it is time, in my opinion, for all who

have leadership responsibilities in higher education to do some soul searching. Higher education must be more flexible and adaptable than in the past. Society demands it. Our programs must be subject to continuous planning and painstaking review and evaluation in each major division of the university and in each major discipline. The rigidity of the past is incompatible with the dynamic demands of the present.

We have changed, and are changing, but not fast enough. In too many areas we continue to be satisfied with the status quo.

One of the major challenges we face is a growing credibility gap on behalf of the publics we serve. Gone are the days when higher education was inviolable——its programs unquestioned——and its decisions unchallenged. Today, questions *are* being asked, programs are being subjected to scrutiny. Our decisions are being more closely examined.

Financial needs of universities have escalated; so has the public demand for more economical and efficient use of available resources. One writer has referred to this development as "more for less . . . higher education's new priority."

In speaking to this subject, Allen Pifer, President of the Carnegie Corporation, which long has taken a constructive interest in higher education, declares that, quote, "This nation can no longer afford the luxury of an unplanned, wasteful, chaotic approach to higher education." In my view, this is an overstatement of the situation. Nevertheless, it does express a view held by a considerable segment of our publics.

Thus, another challenge which faces higher education in the immediate future is how it will be structured and financed. How will the various states structure and coordinate higher education, both public and private? How will it be financed? What share will the state provide? What share will be provided from federal sources? And what share will the student bear? In my view, the trend of placing an ever-increasing burden upon the student should be reversed. Higher education should be provided for qualified students at a price they can afford without unduly mortgaging their future.

Another challenge must be the internal restructuring of the curricula and programs of our universities. All of our program areas——both general and professional——could profit from careful re-examination.

There are numerous and, indeed, revolutionary proposals abroad in the land today. For example, Alexander M. Mood, Director of the Public Policy Research Organization at the University of California, has advanced a much-discussed and rather extreme proposal under the title of "Universal Higher Education." Dr. Mood believes that students in the future will attend college full-time for only one year and that additional higher education will be a part-time activity extending over one's lifetime. He suggests that every youth attend college for one year whether or not he or she has graduated from high school. He believes that the bulk of education beyond the first year should be accomplished at home through the use of learning consoles and video cassettes.

Other concepts are being advanced, together with experiments to test their effectiveness.

The "British Open University" is receiving much attention as a possible model for some American experiments in providing education at a lower cost to the student and to the public. The "British Open University" emphasizes a greater outreach of university programs off-campus, a change in degree structures, and more continuing educational opportunities.

"The university without walls" in this country represents a similar approach to the British Open University concept. This model is being tried at a number of colleges and universities.

Patterns of acceleration of degree programs also are being urged on grounds of economy and efficiency. Credit by examination is being practiced to an increasing extent by colleges and universities, thus permitting acceleration and recognizing off-campus proficiency.

A large role in the future may be assumed by on-campus and off-campus electronic teaching devices. This applies also to exploding library

technology through which on-campus and off-campus access to knowledge will be the key to economy, efficiency and acceleration of the learning process.

The Carnegie Commission under the leadership of Clark Kerr has taken a penetrating look at the whole spectrum of higher education and has come forth with some far-reaching recommendations.

Among other things, the Carnegie Commission proposes "less time, more options." The commission suggests the shortening of the B.A. and M.D. programs to three years. The commission believes that the time spent on the way to the B.A. degree can be shortened by one year immediately without sacrificing educational quality. The commission believes that time spent on the Ph.D. and M.D. degrees can be reduced by an additional one or two years. A considerable number of undergraduate programs and medical school programs are experimenting with these procedures.

In the matter of more options, the commission suggests more opportunities in lieu of formal college work; more points of entrance and exit, stronger emphasis on continuing education programs, and opportunities to alternate employment and study, such as the "sandwich" programs in Great Britain.

The commission estimates that if all the reforms recommended were implemented, operating expenditures for higher education could be reduced by 10 to 15 percent a year below levels that would otherwise prevail by 1980, or by $3 to $5 billion a year. In the opinion of the commission, construction costs in the 1970's could be reduced by one-third or a total for the decade of some $5 billion.

The Carnegie Commission's recommendations are receiving wide and often favorable attention by governors, by legislators and the general public.

What does all of this mean for the higher education community and for those charged with the direct responsibility for professional education, including veterinary medical education?

I am persuaded that leaders and policy makers in the field of higher education should examine the Carnegie Commission's recommendations with care, as well as other proposals and experiments that are being advanced. Not to do so, would leave higher education open to charges of smugness, inflexibility, and unwillingness to consider new, and what many feel are viable options and avenues for the future.

The SREB already has conducted a conference at Atlanta on June 11, 1972, on one aspect of curricular revisions, dealing specifically with approaches to shortening undergraduate degree work. We can be assured that other regional and national groups will examine various innovative and experimental approaches to restructuring and reshaping higher education.

I would suggest that some carefully developed technique be created by each professional discipline to explore these recommendations, proposals and innovations.

It therefore occurs to me that the sponsoring groups of this symposium might appropriately take steps to explore approaches applicable to the veterinary medical education field. Perhaps a joint commission or committee might be created and charged with this responsibility. Such a procedure might result in recommendations holding promise for sound and accelerated progress in veterinary medical education.

GRAND ROUNDS IN MEDICAL EDUCATION WITH MEDICAL STUDENTS UP AND DOWN THE CENTURIES WITH A CRYSTAL BALL

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It is a privilege to report information on medical education to this audience, based on an unsual happening that occurred about one year ago. A distinguished private foundtion, that shall be nameless, offered me a small grant if I would test out their crystal ball with its two new attachments; one of them called the retrospectoscope and the other called the prognosticator. The foundation wanted to validate these instruments for their future use. Since I needed data myself in planning ahead, I accepted the mission provided I could make the plans myself. This freedom was granted and I decided to make grand rounds throughout a little more than a century, talking directly to one medical student in each of four different periods.

Personal interviews were carried out that brought me first hand information from 1870, 1949, 1970, through the retrospectoscope, and, most interesting information from 1990, through the prognosticator. These were refreshing experiences indeed because I found the integration of the data allowed me to derive four postulates that appear essential for learning as well as a series of principles for medical education and educators. It is hoped that this information and conclusions may help as we plan ahead in this period which has a few problems that are as yet unsolved. Because of limitations of time I shall not go into a technical description of the instrumentation which is based on the laser beam transmission of audiovisual communications, retrograde into the past and projection into the future. Also, I can report briefly that the data obtained by this method appears statistically significant within two standard crystal balls.

1870. First I interviewed a student who was about to become a physician in 1870, a century ago, in a small town in Ohio. He was just 21 years of age, was completing his three years of medicine and fully expected to be qualified in the summertime by the board of censors, allowing him to start his own practice. He was a fine looking young man, had a small mustache, and a pleasing way of responding. He was a little surprised when I said I was calling from 1970, but he accepted this. At the age of 18 he had finished his schooling in Ohio and had interviewed the doctor who was to become his preceptor. His preceptor was the only physician in his community of about 1000 people. An agreement was reached and signed by the student and the student's parents stating that he would serve as the apprentice to the physician during three years but would be allowed to go to a

medical school for two periods of 18 weeks each in his second and third year, if all worked out. It did work out well because in the first year he had a chance to begin reading his preceptor's books on anatomy, botany, and materia medica and childbirth. He dissected a sheep his first year. It was evident that childbirth, fevers, and accidents on the farms were important problems for the doctor. The student was able to help considerably with the care including the surgery, setting of bones, making of pills and concoctions. By the end of a year and a half he knew many of the people in the community, knew the sick especially, and began to feel comfortable as he worked in the office and went with his preceptor in his carriage.

With reluctance concerning the value of the program, (his preceptor had never gone to a school of medicine) he was allowed to go to a medical school in Ohio in the city of Cleveland where he had 18 weeks of lectures lasting five days a week. There were six professors and he purchased a ticket for fifty dollars from each of the professors allowing him to attend. One free clinic on Wednesday was attended by patients from all over that part of Ohio. A good pathology museum, skeletons, and one or two cadavers were learning aids. He continued his work with his preceptor all summer and returned once again to take the same set of lectures in the third and last year of his training. He found the lectures of some value but the classes were quite large, being 75, so there was not much opportunity for discussion. He did not examine any patients but he learned of new sciences that were coming. There was no doubt in his mind that work with the physician in his town was the exciting aspect of his training. He was planning to move to a still smaller community when he was qualified so he could know all of the families. His physician preceptor was a good teacher and a respected person in the community although he could do relatively little for many of the seriously ill patients who came to his office or were attended in the home. There was no hospital near enough to use. Fevers carried away ten adults and seven children in one winter month in 1870 and abscesses were a major complication of surgery.

1946. I then asked to see a student in 1946 and found that adjustment on the crystal ball was not too difficult. I interviewed a student who had had four years in a modern medical school and found some remarkable phenomena that were recognized by him and his classmates. He said he had no contact with the community whatsoever and saw practically no patients during the first two years except at considerable distance or with a group of other students. He found the departments were excellent indeed and were almost research institutes unto themselves. There were good opportunities to observe investigation which had brought great advances. These were thrilling. Somehow the faculty wanted to cover everything because everything seemed so important. The available material was excellent but he was overwhelmed by it all. He found that departments were such tight compartments that they did not know what each other was teaching and they did not seem to care. This seemed strange to my student who said he was buffeted from one examination to the other. He had a hard time to decide where to go into practice. Certainly he would choose an internship in a university setting. It was the only thing.

He found that grades and class standing made competition tough with his peers to get a top internship. This made for discomfort with his classmates and the learning was done by the numbers. But he said the clinical work was excellent and he felt better as he worked with children. He wants to do pediatrics. I wished him good luck.

1970. It was now possible to visit a student who was enjoying himself in medical school in the southern part of the United States and I asked him how come he was enjoying it. He said that the school seemed to recognize his needs as a student, had given him a chance to learn on his own with guidance but with considerable freedom. In most of the courses the faculty had joined together to plan for the student with more than one discipline taking part, so that it seemed logical to relate the clinical problem and the basic science aspects from multiple approaches on the same subject. This seemed obvious and permitted him to study on his own from materials prepared by the faculty. The faculty had given heavy responsibility to him to learn on his own and held him to it. He was doing much reading and preparation on his own and was

seeing patients at the beginning of the first year which turned out to be a staggering challenge because he felt so ignorant. However, he said there was little contact with the community and the separation of the clinical and the biologic sciences was highly artificial much of the time.

He was glad to say that the students were not graded and there was no class rank so that they studied together. He found the examinations were tough, demanding, kept him from getting the least bit soft, because they were graded on a pass-fail basis and given right back to him to see. He said that the exam was being used as a qualifying exercise and a learning approach but it was still hard for him to get over his earlier views that the exam was a penalty box. He and his classmates wanted to get out into the community but there was no one there to help them very much. The faculty were busy with other things. A few of the students did reach out to work in other types of clinics where they could get guidance. This excited the class a lot but didn't seem to excite the faculty very much. He was a bright young man, very serious, with a beard––a neat beard.

1990. I adjusted the crystal ball to the interviewing of a student in the year 1990. The image coming from the future was not nearly as clear as the retrospectoscope had brought from the past. There was more fading and static from the laser probe. However, I will give you what data I have, much of it is verbal rather than visual. The actual view of facilities and other details will have to await improvement in the instrument itself. They could not be seen. My interview, however, was with a young man who had begun his career for medicine when he was still in high school. He found it perfectly logical to begin working with patients about once a week to conduct a certain number of observations relating to the patients' problems. His data contributed to the doctor and the other health professionals in a useful manner that was completely understood by the patient. He found that the patients' problems excited him to explore his work in biologic sciences and he was able to continue this contact with the patient, and with the health professionals, as he did his sciences.

There were programs available that he could work through as a series of units on a particular subject or system and he mentioned the heart as an example because he had studied this with other students using assigned materials which were developed just for their group's use. There was always one faculty member on call, like a resident preceptor, and this brought friendly advice to him and all of his colleagues who were studying together. They knew from self evaluation units when they were ready to qualify in a subject and then they did so. He elected to do a project thesis on the embryology of the heart.

He participated in the continuity of observations of his patients as he attended college and medical school. The patient and his family were the units of this endeavor. This he found rewarding. He saw patients on a regular schedule with his preceptor, had gotten to know a considerable number of people and the whole health facility where the physician worked. He felt at home there. They followed the patient in a group practice and employed several diagnostic units and referrals to hospital specialists when necessary for advanced observations or treatments. He liked the feeling that the patient was the primary concern. He found his basic science knowledge was becoming more meaningful to him each year.

He would obtain his M.D., he said, after qualifying in the several biological and clinical requirements. He could do this in several ways depending on his career choice. The time required depended on his program that he worked out with his counselor. He planned to extern after qualifying for his M.D. in a group practice unit in a community that provided consultation by direct audio-visual communications from the clinic to consultants in several areas. He found that there was no separation of the community, the physician, or the experts in the school. Consultation had become universal. He followed all his patients to the hospital. This young man was only 24 and would be ready for practice in one year. I could not see him but he had a fine sense of friendliness and quiet humor. It was refreshing to hear his many enthusiasms. He said there were no wars going on.

Summary. I think you can recognize that these interviews have brought us crystal clear data from the grand rounds with four students from 1870 to 1990--truly a preview over these 120 years. The results might be summarized as follows. The 1870 experience, as shown in Figure 1, shows how the physician was thrust into the needs of the patient and the community. The student was an apprentice to him for three years being allowed reluctantly to attend two courses of lectures in his second and third years. The student certainly knew what was important when he worked with the preceptor and he knew how he was doing as an apprentice because the preceptor told him.

Unfortunately preceptors could not teach all of the basic sciences that were developed in the next forty years from 1870 to 1910, so that the change over of medical schools brought departmental teaching with the needs of departments transcending many others, as shown in Figure 2. The student inherited the departmental research, the excellence and complexity but was often lost as an individual and as a member of community medicine.

Then, in the period 1945 to 1970 the needs of the individual student were discovered without destroying the departmental structure of the medical school. The student suddenly had become a unifying force because his problems in learning became loud and clear in this abundance of excellence. Faculties cooperated to develop interdepartmental instruction and curricula to help the student. There was guidance by multiple disciplines for the student, as shown in Figure 3. There were beginning innovations in pedagogy, but there was still separation of basic science and the patient, separation from the community and considerable separation from the patient.

By 1990 it appears, from the interview of the student, that the needs of the student, the needs of the patient and the needs of the community had all three been recognized without the destruction of the excellence of the departments. Other needs were identified, as shown in Figure 4. This meant that multiple problems were addressed and were not made to be mutually exclusive. There was a continuum of needs that could be addressed as problems. The university became universal to man and not to its own campus. Actually the student found this perfectly normal. Big science could continue as could educational innovation and the application of these approaches to the needs of the patients in their communities.

Once these several needs were discovered, it was possible to agree with one concept, namely, "The fundamental object of medical education is to make good doctors." Also, it became apparent that the student could and would take responsibility to learn on his own and that he would respond as a colleague in learning medicine and in patient care if the environment for his education was carefully planned. In fact four postulates for learning were discovered by this brief experience with the crystal ball and its laser attachments. It was the medical students who made these clear. These postulates are now presented to you, largely as hypotheses, for you to test as you go forward in medicine as teacher and physician. These postulates appear essential to learning, all pervasive in effect, and greater in influence than any one curricular effect. They may have universal application in learning.

Postulate No. 1. Caring About the Student. It is believed that caring about the student is a process that literally rediscovers the student as an individual who has a career that is unique. As soon as the individual's career becomes the unit of education it is recognized that a plan can be developed for the student to learn on his own initiative. This is a privilege.

Postulate No. 2. Informing the Student What Is Important. The student demands from his faculty some estimate of what is important in the methods of learning, in factual material, problem solving and patient care. Without explicit definition of objectives and competencies expected of each student he may be quite lost, frustrated, and upset.

Postulate No. 3. Guiding the Student in Learning. Since the student is the one to do the learning, the faculty can devise increasingly sophisticated systems for the student to learn on

FIGURE 1. 1870 Preceptoral Teaching

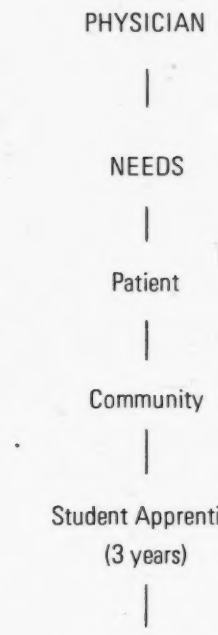


FIGURE 2. Departmental Teaching

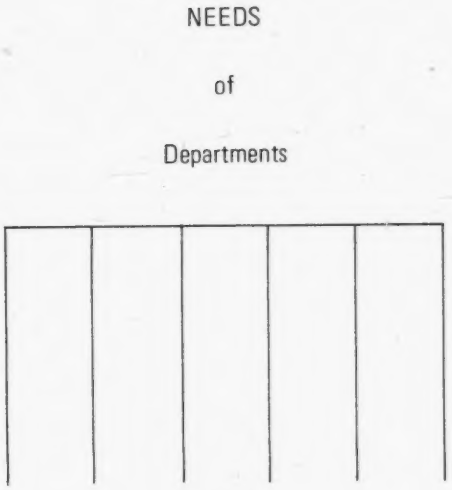
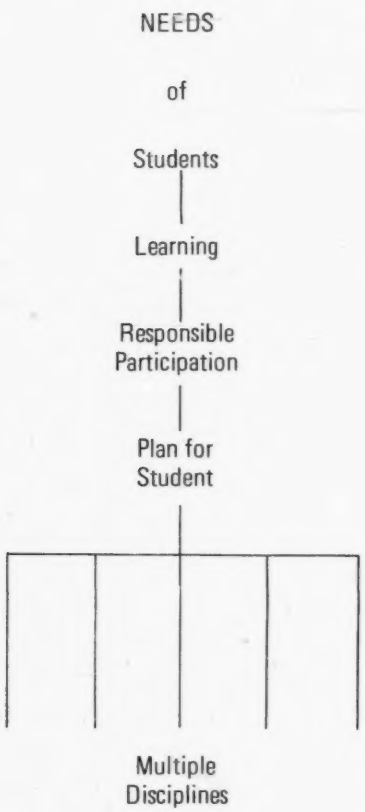
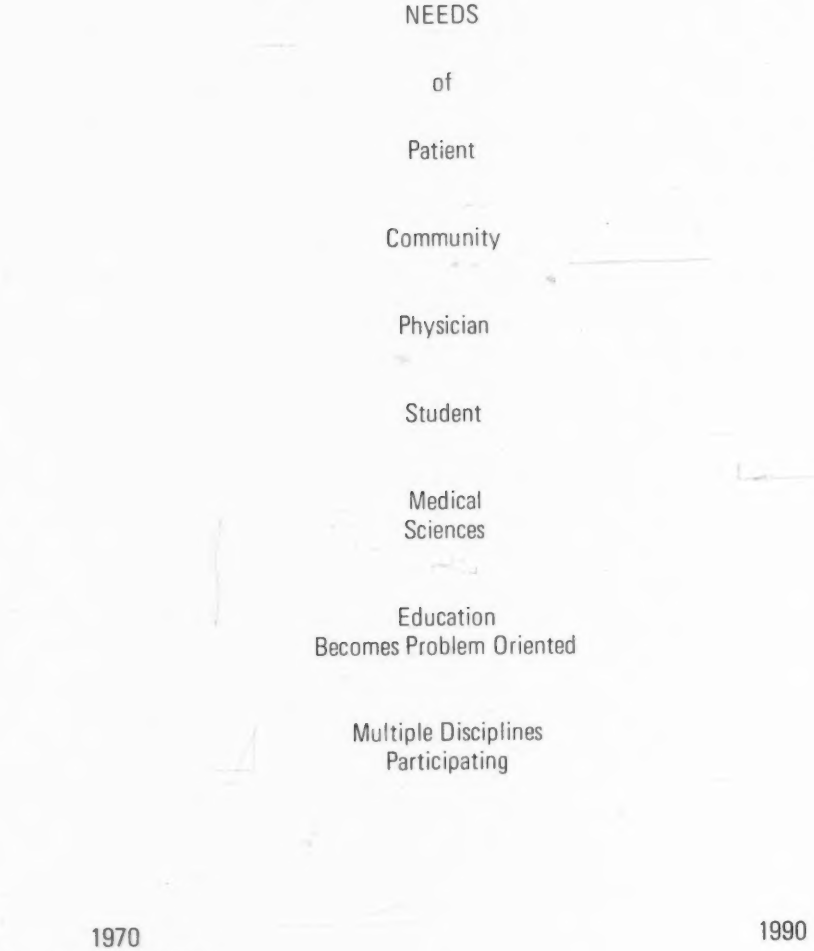


FIGURE 3. Interdepartmental Teaching



1945 1970

FIGURE 4. Problem Approach to Needs in Medicine



his own but with faculty-student interaction of friendly guidance. He wants to know the degree of responsibility that is delegated to him in learning and in patient care and wants to know how to proceed with effectiveness and authority.

Postulate No. 4. Helping the Student Find Out How He is Doing. The student will reach out with initiative if he can learn how he is doing at frequent intervals. This can become a key part of the day-to-day learning experience in all fields. It is the essential feedback system that is needed by the learner to know of his own progress. With such knowledge he will proceed on his own, assign himself tasks, and he will be ready for qualifying exams, such as the National Board, that he can take in stride.[1] (Figures 5, 6, and 7 extend these postulates.)

We are almost done. We have avoided detail by stressing these powerful environmental postulates that may set man free as a learner. But before we leave the student of medicine, please look through the eyes of our future patients because they, too will respond to the same postulates, as so well described by Frances W. Peabody in 1927.[2]

1. Caring about the patient as a person.
2. Making clear what is important to the patient.
3. Guiding the patient in his progress––friendly guidance.
4. Telling the patient how he is doing.

Now, lest we become lost in a humorless society and devoured by the overwhelming problems of today, tomorrow, and the year 2000––please let me join you in some philosophy that is codified as follows for each reference. This section is entitled:

Law of Pedagogy and Innovation

The Reverse Peter Principle or
How to Be a Failure and Like It

When two or more are gathered together some one will lecture.

Hard seats lead to intellectual decubitus ulcers.

Lectures can produce fatty changes of the cerebrum, known as cerebral *pate de foi gras.*

The student cannot learn it all, cannot discover it all, cannot know all the right answers, but he surely tries.

To test the unimportant is too easy, the important may defy measurement.

The swing of the pendulum is better for keeping time than for making policy.

The problem approach makes us interdepartmental colleagues and somewhat honest. Let us try it.

The needs of the patient and the needs of the student can guide us in continuing change.

Laws for Innovators

Do not try to harvest your crop before you plant the seed.

Have your seed ready for your planting; a seed catalogue[3] will help.

Do not plant the seed until the ground is ready.

Examining the roots every day delays growth of the plant.

One person can plant the seed but many are needed for the harvest.

Some plantings take several years to bare fruit. Do not hurry them.

The Peter Principle[4] and How to Reverse It

The Peter Principle is needed to guarantee bureaucratic degeneration and academic stenosis. To preserve this incompetence and confusion, all actions must proceed rapidly without listening to any one. This produces high antibody titers in all participants. Conversely, working from the bottom

FIGURE 5. Problem Approach to: Needs of the Teacher

Knowing Where the Student Is

Knowing Where the Student Is Going

Coaching the Student to Get There

Knowing When the Student Has Arrived

Guiding Student in Self-Education

Arranging for Qualifying When Ready

FIGURE 6

Four Postulates for Learning	*	**"Instruction"**
1. Caring about this student (client).	*	1. Preceptor/Apprentice.
2. What is important?	*	2. Didactic: student receives.
3. Guiding responsibility to learn.	*	3. Problem approach
4. How am I doing?	*	4. Coaching Student Performance

FIGURE 7. Communications, Learning, and Evaluation

Emphasis	Pedagogy and Evaluation
Imperative Essential Required Prerequisite Important	Preceptoral-Apprentice: Medical Science Patient Care Didactic: Lecture Demonstration Syllabus Selection vs. Coverage
Valuable Elective Supplementary Unimportant	Problem Approach: Medical Science Patient Care Unknowns Knowns Case Problems Coach-Guidance Systems: Self-Education Looking up Problems Self-Pacing Self-Evaluation Socratic Method Instructional Materials
Coordinated Relevant Correlated Coupled Integrated	Evaluation Systems: Formative Self-Evaluation Summative

up, you can hear better. This is known as the Reverse Peter Principle or how to be a failure and like it. From the bottom up (abbreviated FBU) can be measured in units of listening before acting (abbreviated LBA). One LBA unit will neutralize one Peter Principle unit with development of a cloudy precipitate and some heat of reaction. The solution is quickly cleared by an excess number of LBA units. This Reverse Peter Principle (RPP) is a delightful state. Optional courses can be arranged.

Use of the crystal ball and its laser attachments and support for these grand rounds are accepted with appreciation from the granting agency. (All rights to the above laws and principles are copyrighted but you have the right to copy.)

FOOTNOTES

1 **Mainstreams of Medicine.** Essays on the Social and Intellectual Context of Medical Practice. Edited by Lester S. King, M.D., Ham, T. H. "A Clinical Investigator Looks at Medical Education. The Discovery of the Medical Student as a Responsible Colleague." pp. 99–100. University of Texas Press, Austin and London, 1971.

2 Frances W. Peabody, The Care of the Patient, J.A.M.A. **88**:877, 1927.

3 Burpee's Seed Catalogue of Pedagogic Varieties lists over 425 species. Many hardy perennials are available for distribution by the author (T. H. Ham). Listings available on request.

4 Man is promoted until he finally reaches the level of his incompetence. Peter, Laurence J. and Hull, Raymond, **The Peter Principle**, William Morrow and Company, Inc., New York, 1969.

MINICOURSES—WHAT ARE THEY?

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Dr. Postlethwait's presentation was drawn from the following manuscript* and the study guide entitled "Minicourses--What Are They?" by S. N. Postlethwait and Frank Mercer copyright 1972., Purdue Research Foundation, Purdue University, Lafayette, Indiana. Copies may be obtained by writing the author.

STUDENTS ARE A LOT LIKE PEOPLE!

The technological revolution is met with mixed emotions by both educators and students. The reason is relatively simple--people do not like to be replaced by machines and people do not like machines as a replacement for people. Education is more than an information dispensing and absorbing process. It requires a comradeship of sharing and exchanging of experiences and an excitement that grows from common interests and hopes between teacher and student. Most of us can trace our interest in a specific topic to the inspiration derived either directly or vicariously from some other human being.

Does this mean that one must reject the utilization of all technical devices in the development of an educational system? Far from it! Properly used equipment may very well enhance the personal relationship between student and teacher. Some of our most effective and powerful lessons are learned from teachers whom we have never seen but with whom we have a fellowship derived through some spanning medium such as the written word. Clearly this written 'bridge' between teacher and student has been a great boon to all of mankind and, until recent years, has been our only link to many of the great teachers of the past. Fortunately, technology has expanded our potential for even more intimate access to great teachers and with greater facility. The dimensions of audio and visual now can be preserved and retrieved and fantastically convenient vehicles. The imagination of man for utilization of these devices individually or in combination with the written word and/or tangible items is one of the major limiting factors in education today.

If one uses the education model proposed by Hopkins of a 'student on one end of a log and a teacher on the other' the role of technological devices becomes more clear and less foreboding to many of us. The purpose of technology in this context is to 'capture' to the greatest degree possible the events or activity between the 'good teacher' and student in a one to one relationship, so that the product can be duplicated to accommodate many students in a close approximation of the original situation. With today's audio and visual devices it is possible to involve the student with nearly every exposure to

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* Postlethwait, S. N. "Students Are A Lot Like People," **Journal of the British Universities Film Council**, No. 8, January, 1972.

the subject conceivable. The program can contain tangible, printed, audio and visual materials in any combination in which the 'good' teacher wishes to use them. The only limitation is the capacity of the teacher and student to relate to the simulated situation.

In 1961 at Purdue University a program was begun which has been called the Audio-Tutorial system. The basic philosophy of this system is very simple. A 'good' teacher is asked to assemble the items he would use to teach one student and, while sitting among these items, to record on audio tape the conversation he would have with one student as he tutored that student through a sequence of learning activities. The product--the tape, tangible items, visuals and printed materials can be duplicated as many times as necessary to accommodate any number of students. Obviously the program produced in this way will be limited by the cleverness of the teacher but the corollary is also true--a clever instructor can intimately involve the student in important and useful learning activities. The student now has access to the clever instructor in more ways than through the written word. Subtle communication through connotations by inflections in the voice are provided by the audio tape and the tangible, visual and printed materials assembled can exhibit the full skill of a great teacher to involve a student in a sequence of learning activities or a 'symphony of learning.'

The Purdue program evolved slowly. The first programs were mere lectures on tape and relied on audio as the sole medium of communication. Later, other media were added including tangible items (live plants, models and equipment for experiments), printed materials (textbooks, study guides and journal articles) and visuals (2 x 2 slides 8 mm film and photographs). Study programs were set up in booths in a learning center which was open from 7:30 a.m. until 10:30 p.m. Monday through Friday. Students came in at their convenience and spent as much time as necessary for them to master the lesson. An instructor was available at all times to help students on an individual basis if necessary. This study session was referred to as an independent study session (ISS).

Two other study sessions were included in the system: (1) a general assembly session (GAS) and (2) a small assembly session (SAS).

The GAS was scheduled on a weekly basis for one hour. It included several hundred students in a large lecture hall and involved them in the kinds of activities best done in a large group. Specifically, this assembly was used for major tests, long films, help sessions and an occasional lecture.

The SAS included eight students and an instructor and was scheduled on a weekly basis and used primarily for short written and oral quizzes. It served in an administrative role and for the identification of students with a specific instructor in the large unstructured course.

The course structured in the above pattern provided a full range of learning activities and situations. The ISS permitted students to enjoy some important features of a learning system that are not commonly available in a conventionally taught course. Some of these include:

1. **Repetition**--There is little question but that the nature of many objectives required repetition for their achievement. However, repetition ought to be engaged in in an intelligent fashion and adapated to the individual needs of a particular student. In a course with 500 students the teacher cannot possibly make the adjustments in repetition for individual student need. Only the student can determine intelligently how much repetition is necessary.

2. **Concentration**--Most classrooms are not organized to permit students to concentrate during their study. Students are distracted by one another, and other dissociated events which may be occurring tend to distract the student's attention from the subject at hand. The audio-tutorial system permits the student to isolate himself from the surrounding environment by covering his ears with the earphones and by the use of other media to reduce his awareness of his surroundings.

3. **Association**——In a study of plant science the major objective is to learn about plants. It makes sense therefore that a study of plants should be conducted where plants are available for observation. Diagrams, charts, models, photographs, and other such devices should be a 'means to the end' so that students' attention is directed to the actual plant. The audio-tutorial system provides an opportunity for the student to have an object available at the time he reads about it, does experiments, etc.

4. **Appropriate sized units of subject matter**——People vary considerably in the amount of subject matter that can be grasped in a given amount of time. Programmers have demonstrated that most people can learn almost anything if it is broken into small enough units and the student can take time to become informed about each unit before proceeding to the next. Any program of study therefore should provide each student with an opportunity to adjust the size of the unit to his own ability to assimilate the information, so that those who can absorb large quantities of information may do so in an unrestricted fashion, whereas others who must proceed more slowly are permitted to do so. The audio-tutorial system allows the student to proceed at his own pace and to break the subject matter into units commensurate with his ability.

5. **Adapt the nature of the communication vehicle to the nature of the objective**——It is logical that no simple vehicles such as lecturing or a text book can achieve the full spectrum of objectives for a complex subject. The student's experiences should not be confined to any particular vehicle as film, audio tape, text book, or a lecture. In cases where the development of a procedural skill is necessary, there is no substitute for the student doing this procedure himself. A properly structured course, therefore, would carefully define objectives and not try to mold objectives to fit a favorite medium (lecture, for example) but instead would use the medium best adapted to the nature of the objective.

6. **The use of multi-media**——Individuals differ in their responsiveness to different kinds of communication devices. Some people learn well through reading, some can learn best by auditory communication, and others can learn best by literally handling specimens and performing experiments. The audio-tutorial system thus provides an opportunity for subject matter to be covered in a great variety of ways with the student exploiting the medium which communicates most directly and effectively for him.

7. **Finally, and most important, the integration of learning activities and situations**——It stands to reason that if learning events are to be complementary and to have some relationship, they should be brought into close proximity and properly sequenced. The conventional structuring of a lecture, recitation, and laboratory does not take this into consideration but rather may expose a student on Monday to a lecture concerning a given subject; perhaps on Wednesday the student does experiments related to that subject; on Friday a recitation will involve the student in some exposure to the subject; and then on Sunday night, late, the student may read on this subject from text. The audio-tutorial system permits the student to bring all of these learning experiences into an integrated sequence so that each learning event may enhance or complement the adjacent ones and thus result in a 'synergistic' effect.

The individual nature of human beings cannot be over emphasized. Any good educational system must be based on the fact that 'learning must be done by the learner.' It must be involving the student in the process and must always provide a high degree of flexibility and adaptation to individual needs. However, superimposed over this quest for individuality is the dependence of each student on teachers to guide, facilitate and stimulate him to engage in appropriate learning activities. Today's technology provides new dimensions to accomplish this and, when these new tools are used properly, they provide more intimate access to the teacher——they do not dehumanize!

MINICOURSES IN VETERINARY MEDICAL EDUCATION

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Dr. Postlethwait has described and defined the minicourse concept. My task is to call attention to present efforts of veterinary educators to place this type of educational methodology "on the line" and persuade you of the need for its wider adoption by veterinary educators. I could have circulated a letter to each school asking them to detail existing programs. It seemed more logical to conserve time and postage by using those items presented at Detroit last year and those to be on display at New Orleans this July. Politically it gets me "off the hook" in the decision making process of what to include and what to omit in the brief time allocated for this presentation. The titles will not be included in the proceedings as they are already published in an easily found source, that being the 1971 and 1972 convention issue of the Journal of the A.V.M.A.

Because of the numbers of the titles shown, my format of presentation will be with two projectors and a sound tape. The madness in my methodology will be apparent within a few minutes.

Presentation of Slides (76)
and Audio Tape (6 minutes)

This presentation should have, in the terminology of the professional educator, caused a "change of behavior" in you, "the students," attending the 5th Symposium on Veterinary Education. You should be confused, apprehensive, awed and collectively of one mind asking the question "What-in-hell is he wanting us to know?" If this is indeed your mood, then you are, therefore, kindred spirits to a faculty member trying to organize a course with 192 contact hours allocated and 900 hours of information to transmit. His tools are textbooks written for his peers and not the student, classrooms designed as boxes and not learning centers, audio-tutorials developed by others that he cannot afford and inadequate time to devote to preparation. Lack of agreement among his peers (national and local) as to the capabilities of the end product and the ever present specter of National Board Exams add to his burden.

You are also kindred spirits to the student. If you, who have responsibility for a segment of his education, are confused these days, imagine his dilemma. You ask him to review, skim, survey, smell, practice, see, hear, write, analyze, present, attend, care for, summarize and place in a meaningful perspective, hundreds of "bits" of knowledge and skills.

You may think I am discouraged, dismayed, bitter and hypercritical of present educational methodology in veterinary schools. I may be awed but not discouraged by the multiple methods, confused but not dismayed by present lack of program definition, bone tired but not bitter about our progress, and constructive but not hypercritical of our collective efforts here to improve the educational process. Never before has this number of veterinary educators gathered together for the express purpose of methodology. It warms the heart of one who for two decades has pleaded "the school is for the children."

What then are the solutions to the problems we all face? From my view as a former student, teacher, practitioner and administrator an order of priorities emerge:

1. Identify, encourage and reward those unique individuals who can survey, sort, reorganize, present, evaluate and measure their subject matter area and reduce the amount of available material to a quantity realistic to the credits and hours allocated.

2. Expand the efforts of species, systems and discipline-oriented groups in an effort to further identify what is essential for a veterinary student to master and delete that portion more suited to post-graduate and peer group needs.

3. Establish the format for exchange of educational materials including test questions. The expanded base of the AAVMC, if approved here during this symposium and adopted in New Orleans in July, will provide the mechanism by identifying one individual at each school who could serve as a coordinator. Inherent in the expanded organization, is a Journal of Veterinary Medical Education.

4. Write a series of textbooks tailored to the needs of the student rather than the authors' peer group. The perfect example is the new "Guide to the Dissection of the Dog" by Evans and de LaHunta. Those authors are to be congratulated for a job well done.

5. Use the learning experience of this symposium to initiate a minicourse approach to veterinary education. This will cause us to more clearly state our objectives, select media on an effectiveness-cost ratio, and provide for the inherent variation in student learning ability.

This brief overview of the profession's efforts to utilize new technology and methodology is now concluded. May the 5th Symposium be a roaring success!

MINICOURSE PLANNING

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Would you start to produce a movie without a director, without actors, without a technical crew, reliable equipment, potential audience, estimate of probable success, or, most of all, without a script? If you were making home movies your answer would probably be yes. If you were producing feature movies for commercial release, (unless you were Andy Worhol) your answer would be no. The parallel between the differences in your answer and the differences in the quality of the two movies (three if you count Worhol's flicks) is obvious. The same line of thought can be applied to writing (books vs. diaries), music (operatic recording vs. singing in the bathtub), speech (casual conversation vs. oration) or cooking, paintings, and even *minicourses.* Generally speaking the quality, the effectiveness is directly proportional to the planning and care in production.

The traditional lecture and demonstration will also improve proportionally to planning and care in production but, unfortunately (or fortunately, as the case may be) they are not generally recorded and are not subject to repeated reuse as are movies, books, and records. If a movie is bad the first time, you see it--it only gets worse with repeated viewing. Minicourses, if for no other reason, deserve special planning and care in reproduction since what we say will be there to be heard over and over and over . . . We find ourselves in the publication business, whether it be local, limited or universal.

Minicourses are expensive! They are expensive in terms of time, equipment, space, materials and personnel. They can solve some problems of scheduling, individual differences between students, student-faculty contact time, etc. and yet may create other problems of logistics, filing, retrieval and scheduling perhaps just as great. Therefore, planning a minicourse should also include consideration of the advisability of selecting an alternative approach. If there is validity in the recommendation that a good learning situation is "a student on one end of a log and a good teacher on the other end of the same log" (and there are many cases in veterinary medicine where we approach this situation) then perhaps everything need not be a minicourse. There are too many things that need to be programmed to waste time and effort on those that do not.

In their Study Guide, **Minicourses--What Are They?** (Purdue Research Foundation, 1972), Postlethwait and Mercer outline a development sequence for Minicourse production. Their approach is both logical and sound and is presented here in outline only. The author's detailed explanation is given in their publication.

It is interesting to note the choice verbs that appear in the outline. They are: develop, evaluate, state, construct, select, storyboard (used as a verb), assemble, rehearse, specify, prepare, transcribe, prepare, evaluate, transcribe, revise, and finalize. Suppose that much effort was placed on the preparation of any presentation, be it minicourse or other.

From the production standpoint the storyboard (step six in the Initial Development Stage) is very useful. The storyboard is a technique used to

Modified from: Postlethwait and Mercer, Minicourses - What Are They?
Purdue Research Foundation, 1972

Overview

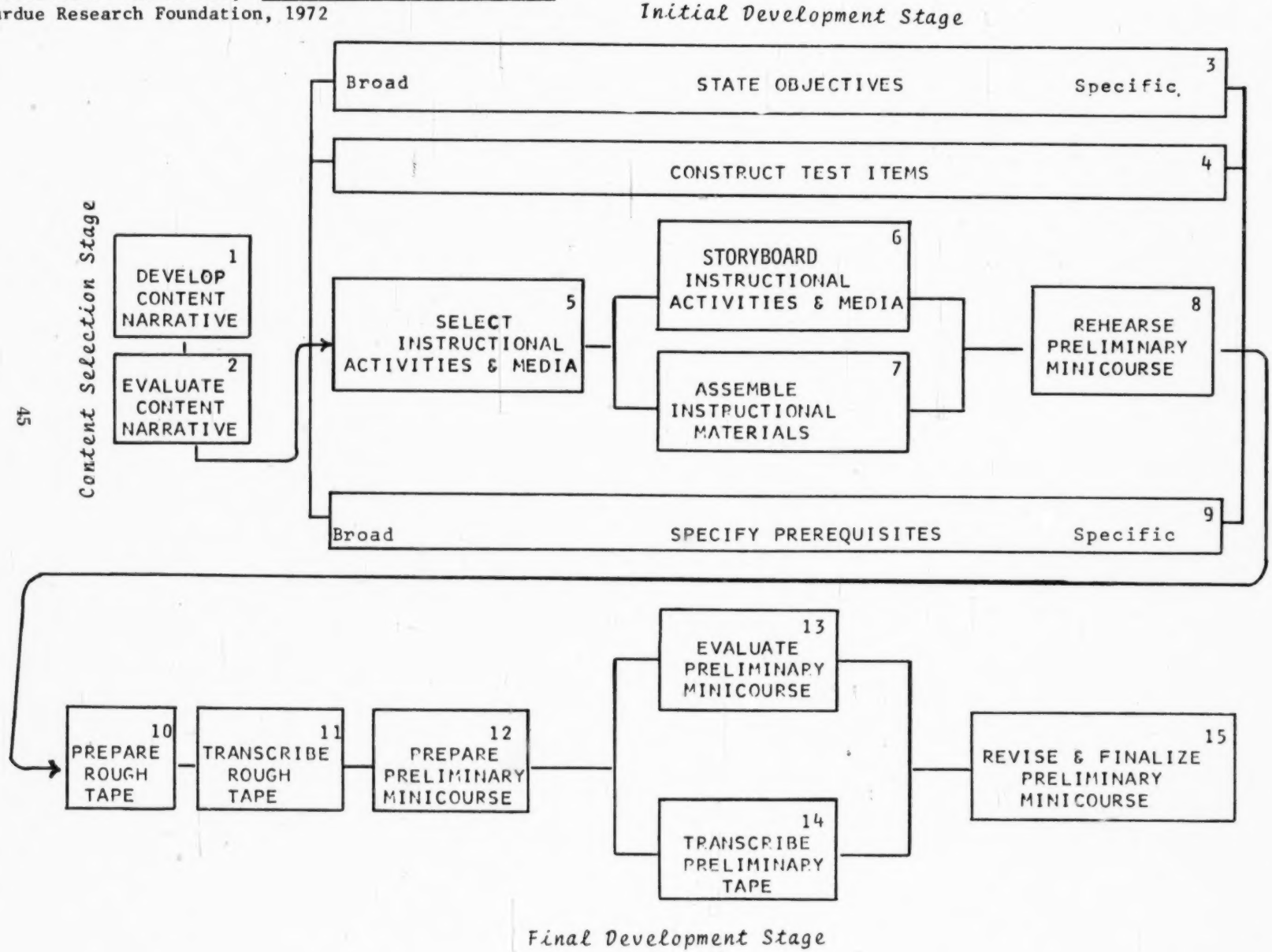
	PHASE			
	I	II	III	IV
Cperation	Preliminary Development	Pilot Testing	Field Testing	Publication
Product	Preliminary Version	Trial Version	Field Version	Final Version

(Most all of our programs in the Veterinary School at Purdue fall in Phase I or II. Many will never go beyond this stage because they are constantly being modified and probably will never be considered for outside use.)

PHASE I

Modified from:

Postlethwait and Mercer, Minicourses - What Are They?
Purdue Research Foundation, 1972



sequence instructional materials in the planning stage. It provides a means for shifting cards depicting the various elements of a program until the most suitable sequence is achieved. It provides flexibility for adding or deleting items easily. It also provides a very suitable device for multiple input from two or more people working together. It can provide a visual concept of the temporal relationship between the various elements of a program and it can serve as a production guide throughout the program development. And it is inexpensive! This is the step where major modifications should be made. Changes in production are very costly.

In the Veterinary School at Purdue we like to develop a ***production script*** from the final storyboard arrangement. This script can be duplicated and given to all production staff. It facilitates coordination of activities and eliminates duplication of effort.

Planning should also include a realistic production time table with a general meeting of all technical staff outlining the overview of total program. In depth discussion and understanding about production capabilities and limitations is very important.

One should exercise care about copyright infringement. This is too often discounted by individuals in their enthusiasm for producing a program. The "fair use" interpretation of the Copyright law for "scholarly purposes" may not hold when it comes to multiple copies rather than single classroom projectiles. This consideration becomes even more important when we receive remuneration for our efforts in developing a program which contains copyrighted materials without releases. Recorded music is now covered by the copyright law. Ideally, planning should allow time and money to provide original, accurate, custom made materials, produced by professional medical illustrators and photographers.

When motion pictures are needed, production schedules should be planned to provide time and money for quality production. Portable video tape recorders often prove useful in working out camera angles and action without the expense and time loss in shooting test footage. The instant replay capabilities provide an excellent means of motion picture rehearsal.

Try to plan an easy and natural approach to your audio tape but try to avoid folksiness and corn. Use only those jokes and expressions that can bear being heard over and over and over . . .

Plan a flexible format that will lend itself to modifications and revisions. Synchronized slide-tapes, filmstrips, and slide-records should be avoided, at least in Phase I.

Consider the logistical limitations of the facilities you have for presenting the materials. One lab for one course offers no problem but scheduling minicourses into multidisciplinary laboratories generally means competition for time and space. Plan the course in short segments (10 to 15 minutes) so students can move through segments quickly. A fifty minute program divided into five segments will allow five students to be working simultaneously. Where as the same course, unbroken, only allows one student to work on it at a time.

Even though Postlethwait and Mercer do not use the term ***publication*** until Phase IV in their Mincourse Development Sequence, it could be interpreted as beginning with Phase I. It is a matter of degree or extent of publication. We may be only publishing on the local level but when we start to record and formalize our concepts into minicourses, AT programs, movies, slide-tape lectures or in any other format that is for others to utilize, we are publishing. There have long been established rules governing publication--both legal and ethical. The fact that we are now

becoming the publisher as well as the author does not relieve us of our responsibilities to these rules. In fact, it increases the responsibility.

In our excitement to develop minicourses and other programmed instructional materials there is too often the temptation to lay aside these rules and also considerations of quality control in the name of expedience for scholarly purposes. This temptation and practice could be avoided if the initial planning included considerations for proper financing and realistic estimates of production costs and time.

If we include these considerations in our initial planning, then perhaps we will be closer to producing minicourses that can be used over and over and over . . . Even though we have a captive audience we owe them more than home movies and homemade productions.

THE KEY PERFORMANCE OBJECTIVES

R. F. Mager, Ph.D.
Mager Associates, Inc., Los Altos Hills, California

Doctor Mager's presentation was drawn from his books entitled: **Preparing Instructional Objectives,** copyright 1962, and **Goal Analysis,** copyright 1972, Fearon Publishers/Lear Siegler, Inc., Education Division, 6 Davis Drive, Belmont, California 94002.

These books were provided each pre-registrant as pre-conference reading materials.

Following Doctor Mager's formal presentation the conferees participated in small work group sessions where mini-course topics were chosen and objectives written. The participants then re-assembled in general session for a question and answer period with Doctor Mager.

MEDIA—WHICH ONE

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There have been times when each of us has felt dissatisfied with our attempts to select the appropriate media for an instructional presentation. Which medium is best for which kind of teaching or learning activity? Can we develop a classification system or "cookbook" approach to the listing of an appropriate medium or combination of media which is best suited for a given subject, instructional procedure, or learning experience?

Research Findings

Over the past half century a number of studies have been conducted in an attempt to establish the relationship of various media to specific types of learning outcomes generally classified under the heading of cognitive, psychomotor and affective learning. The results have been somewhat disheartening in terms of generating media selection criteria which can be easily applied to operational instructional development problems.

Although media have consistently demonstrated their ability to communicate effectively and efficiently in a variety of teaching/learning situations, there has been no clear-cut superiority of one particular medium over another in producing satisfactory learning outcomes. This generalization does not, however, discredit the findings of specific studies which do show that under certain specific circumstances a particular medium may perform well in one instructional situation but be unsatisfactory for a subsequent instructional event within the same instructional program.

In addition to the lack of appropriate guidelines for the selection of media, our task is further complicated by the wide range of media choices available. Few of us have had the kinds of operational experiences which enable us to feel confident about selecting the media which will best facilitate efficient and effective communication within the context of a given teaching/learning process and related instructional environment.

Where then can we turn for guidance in relating media to the instructional and learning tasks to be performed? The media research previously cited provides a clue. These studies suggest that the effectiveness of an instructional presentation or program may depend more upon the learning message design than the particular medium used to communicate the information to the learner. This is to say that desired learning outcomes may be achieved equally well by any number of media, providing factors such as learning objectives, the instructional methods, and learning activities are optimized.

Instructional Planning

This leads us to the recognition that there does indeed exist a body of scientific knowledge which can be directly applied to the development and implementation of new and improved educational programs. The instruction design model (Figure 1), developed by Dr. Jerrold Kemp, reflects a systematic approach to educational programming. Each one of the steps should be included in the process of creating the final educational product.

Instructional Design Model*

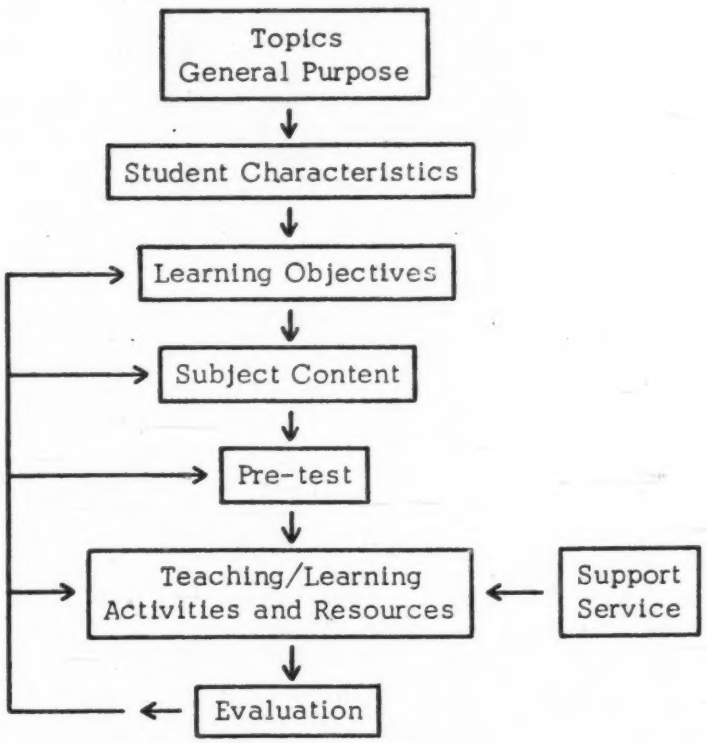

Figure 1

The Instructional Design Model developed by Dr. Jerold Kemp, Coordinator, Audiovisual Production Services, San Jose State College, San Jose, California.

* Kemp, Jerold E., Instructional Design, Fearon Publishers, Belmont, California, 1971

The significance of this approach is that it focuses on learning rather than on teaching. Clearly stated and measurable learning outcomes are defined first, followed by the designation of content, the specification of teaching/learning activities and resources, and the assignment of support services. Essential to the success of this instructional design approach is the systematic evaluation of each step in the developmental process plus the assessment of student performance once the instructional program becomes operational.

There are literally dozens of similar instructional planning and design models in existence, all presenting essentially the same basic steps, perhaps with more or less detail and in a different sequence. Since the focus of our discussion is on the area of media selection, the diagram in Figure 2 presents a simplistic ordering of the steps involved in instruction/learning program development.

Instruction/Learning Modalities

The identification and specification of the instruction/learning modalities are prerequisite to media selection. The modalities fall into three basic classifications:

1. Exposition--typified by the lecture-demonstration usually involving a one-way communication from teacher to student, supported by the use of media.

2. Independent Study--typified by printed material involving student interaction with the media.

3. Interaction--typified by small group discussion involving student-instructor interaction supported by media.

These instruction/learning modalities emphasize the role of the teacher as designer of instructional presentations, creator of learning experiences and as an individual counselor for the student.

Emphasis is placed on the identification of the needs, interests and concerns of the learner in the development and implementation of learning programs. Stress is placed on the kind of behavior exhibited by the learner following instruction and the development of suitable means for increasing feedback and assessment of learning outcomes.

In effect, we are talking about the strategies and techniques involved in the development and implementation of these modalities. Strategies represent our plan for reaching the stated objectives and are composed of the methods and procedures which in our judgement will insure that the learner does reach the stated objectives. For example, we may choose to provide the student with all of the cues needed to accomplish a learning task. This strategy could be implemented by lecturing, giving a demonstration, or assigning a programmed text. On the other hand, we could elect to give the student no cues and allow him to discover ways of achieving the learning objectives by a problem solving technique. Figure 3 presents a simplified functional classification of instruction/learning modalities.

Media Resources

The act of communication takes place when two bodies exchange information through the use of some medium. In order to improve the act of communication, we must seek to improve either the bodies which exchange the information (learner, teacher, or device) or the medium through which they communicate.

Audiovisual materials and devices have ordinarily been employed as ***aids*** to the instructor in presenting information to learners. The lecture method of presentation, supplemented with projected images and demonstrations, is the most common example of this use of the audiovisual aid approach.

Instructional ***media***, on the other hand, are resources which present a complete body of

INSTRUCTION/LEARNING PROGRAM DEVELOPMENT MODEL

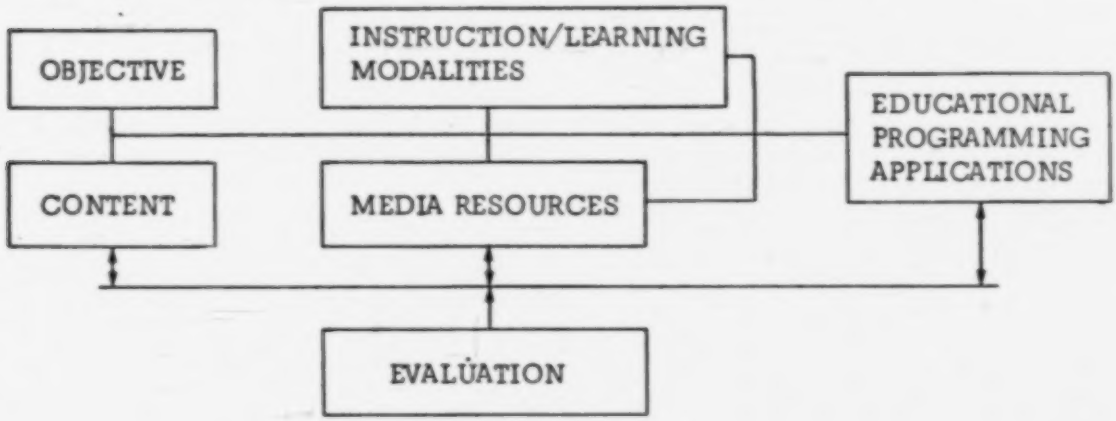

FIGURE 2

FUNCTIONAL CLASSIFICATION OF INSTRUCTION/LEARNING MODALITIES

MODALITY	TECHNIQUE	APPLICATION
Exposition	Lecture Demonstration	Introduce new subjects and activities Motivate students Present new developments Present specialized resources
Individualized Learning	Programmed instruction Problem solving Laboratory practice Assignment Mediated presentation	(All listed applications)
Interaction	Discussion Conference Seminar Debate Workshop	Review Clarify Correct Reinforce Synthesize

FIGURE 3

information, are largely self-supporting, and are primary rather than supplementary resources in the teaching/learning process.

Although we recognize that more often than not these terms are interchanged in common use, we need to keep in mind that media implies the combined man/device/material interface with the learner and includes the concept of audiovisual aid. Our task now is to look at the media options available to us, identifying their characteristics and subsequently establishing some type of operational criteria by which we can select media with the best chance of meeting specific instruction/learning requirements.

The seven primary media classification categories and some examples of each are:

1. Realia: Specimens, objects, people, events,
1. demonstrations.
2. Printed: Text, workbooks, captions.
3. Still Visual: Photos, slides, overhead transparencies, filmstrips.
4. Motion Visual: Motion pictures, television.
5. Audio: Tape and disc recordings.
6. Programs: Programmed Instruction, Computer-Assisted Instruction, combined media.
7. Simulation: Games, models, demonstrations.

Each of these categories can be further defined and described in terms of their instruction/learning application characteristics. This simplified listing is presented to illustrate an approach which could be used in the development of useful data required in the media selection process:

		Advantages	Limitations
1.	Realia	Present reality Permit use of all senses	Availability Accessibility
2.	Printed	Low cost Transportability Accessibility	Reading skill dependent Use of only visual sense

3.	Still Visual	Ease of sequence change (except filmstrip) Transportability Ease and speed of preparation	Use of only one sense Projection equipment required (except photo)
4.	Motion Visual	Close to reality Capable of depicting motion	Accessibility Expense Equipment expertise required
5.	Audio	Transportability Relatively inexpensive Ease of equipment operation	Use of only audial sense
6.	Programs	Instant feedback May be adapated to individual	Expense Lack of available materials
7.	Simulation	Close to reality Often inexpensive	Lack of available materials

Research suggests that a combination of media may be more effective in enabling learners to achieve objectives by providing for differences in learning styles. In general, learning efficiency and effectiveness is increased when media are employed in teaching/learning events which closely resemble the nature of the final student performance requirement.

Figure 4 is a media decision chart indicating the points at which discriminations between media may be made within the still visual, motion visual, and audio categories.

Our final step is to identify a set of selection factors which we can use in conjunction with the data provided in the form of learning objectives, content, instruction/learning modalities and media characteristics. Gerlach and Ely identify five selection factors which should be considered:

1. Appropriateness——Is the medium suitable to accomplish the defined task?

2. Level of sophistication——Is the medium on the correct level of understanding for my students?

3. Cost——Is the cost worth the potential learning from this particular medium?

4. Availability——Are the material and equipment available when I need them?

5. Technical Quality——Is the quality of the material acceptable? Readable? Visible? Audible?

Summary

Media are resources which can provide the conditions of learning for the acquisition of knowledge, skills, and attitudes. Media selection is one step in a systematic approach to instructional planning and design.

The criteria for media selection are dependent upon the learning objectives, content, instruction/learning modality, and instructional setting. While research has established some guidelines for determining what medium is most appropriate for particular learning situations, there is no definitive, all-encompassing statement of media selection criteria.

MEDIA DECISION CHART

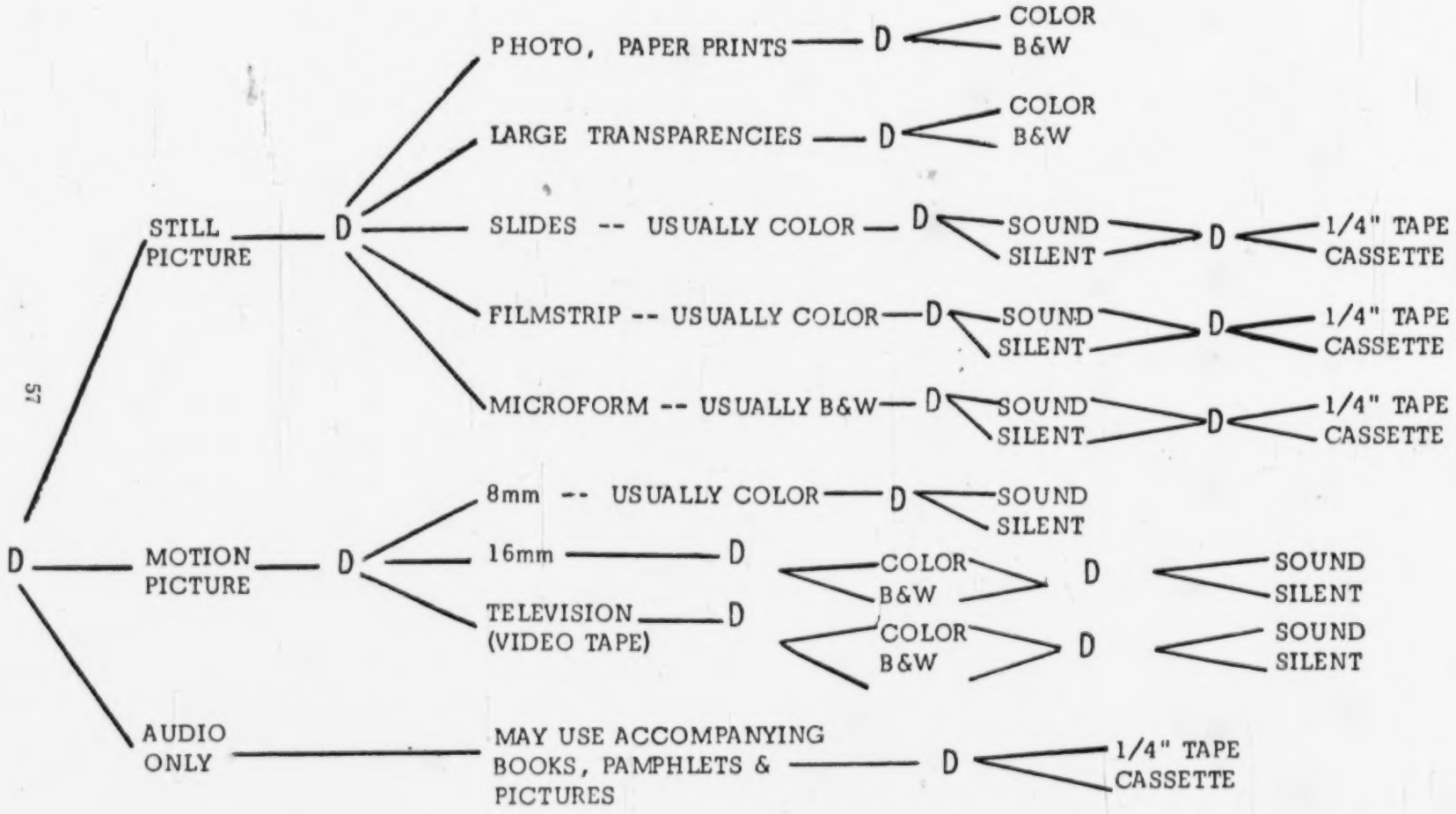

Figure 4

The difficulty of the task of media selection is increased by the proliferation of media choices available and the limited operational experience of most instructors and instructional designers.

What we have outlined is an approach to media selection. There is no definitive answer to the question: Media--which one? There are, however, lots more questions, and asking those questions can insure more appropriate selection of media for your instructional programs.

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TIEING IT TOGETHER: TRENDS IN EDUCATIONAL COMMUNICATIONS AND TECHNOLOGY*

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As educators, we are concerned with educational technology as it relates to the development and implementation of comprehensive programs in veterinary medical education. When we speak about educational technology, we are talking about the management of information, the technological devices and systems used in storing, retrieving and displaying information; and the personnel and financial support required to implement our educational programs.

Educational technology is in a continuous process of change related to developing new educational objectives, improving instructional practice, and organizing and implementing curricula.

Our application of educational technology to the teaching and learning process should place emphasis on the learner and his achievement. We are concerned with improving the conditions of learning, especially the individualization of learning and the ultimate change in the learner.

This changing educational technology suggests several guidelines which we may apply in planning for teaching and learning activities and selecting instructional resources:

1. Improvements in education and training have generally been more closely associated with innovations in educational procedures and techniques than with technical devices and systems. Independent study, individualized learning programs, programmed instruction, team teaching, and small-group interaction are a few of these educational procedures.

2. In general the effectiveness of an instructional presentation depends primarily on the learning message designed rather than on the medium employed in the communication process. The inherent "hardware" characteristics of media have never been the primary factor in the improvement of the effectiveness of instruction.

   Technological devices and systems frequently make possible educational changes that have long-range and far-reaching effects, but these changes depend upon the manner in which the technology is employed and the purposes which it serves. Consequently, technological devices and systems should be looked upon as the means of implementing new educational procedures and techniques.

3. Educational technology has the potential of handling most of the routine instructional tasks usually performed by the instructor. It can provide the means of assisting the educator in organizing and handling the vast

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* Condensed version of a multimedia presentation given at the 5th Symposium on Veterinary Medical Education, Athens, Georgia.

amount of data he derives from and about the learner. It can provide the means of efficiently employing the vast store of information, educational materials, and programs which will increasingly become available to the educator in creating, programming, and evaluating learning experiences.

4. Identification of the needs, interests, and concerns of the learner are essential in the development and implementation of learning programs. Stress is placed on the kind of behavior exhibited by the learner following instruction and the development of suitable means for increasing feedback and evaluation of learning outcomes.

5. Individuals must be geared to accommodate to rapid changes in educational programs, instructional methods, and technological resources. New approaches to teaching and learning require different activities and functions on the part of all concerned--teacher, student, media personnel, administrators, and technicians. There is an increased division of labor in the design, preparation, and implementation of educational programs and learning activities. The traditional role of the teacher as presenter will change to the role of developer and manager of learning experiences. The learner will become a more active participant in the development, preparation, and evaluation of the learning programs he uses.

Learning Activities

Individualized Learning

It has been estimated that individualized learning programs will ultimately account for a large percentage of a student's education and training in medicine and the health professions. This commitment will have profound effects upon our approach in planning future instructional/learning systems and facilities, plus the required media support resources and services.

These individualized learning activities will not be restricted to specified on campus spaces but will occur in many different locations employing a variety of facilities and services, including remote learning centers, homes, vehicles, and nearly any location the learner may choose.

Individualized learning activities will frequently be under computer management providing a capacity to interact with the student and prescribe learning experiences tailored to the specific learning characteristics and needs of the student.

We may anticipate increased miniaturization of instructional devices with a capacity to store, retrieve, and display a wide range of learning resources. These devices will provide for interactive student response, self-testing, evaluation of performance, and feedback of the data to a centralized total information system for automatic record keeping and student or instructor retrieval for analysis, review, and counseling purposes.

Group Learning

Long-range emphasis on individualized learning suggests a reduction in the need to bring large groups of students together at one time in one location for instructional purposes. Although large group instruction will continue to play an important role in the overall educational program, greater selectivity will be applied as to when, where, and under what conditions this instructional modality will be employed in the teaching/learning process.

Small-group learning activities will continue to play a vital role in the synthesis and integration of learning provided through self-instruction and large group presentation.

Both large- and small-group instruction will require direct access to a total information system for on-demand display and recording of relevant information and learning materials. These instructional modalities will also require a comprehensive media software and hardware support system.

Learning Materials

The preparation of learning programs will require, initially, the use of existing media formats such as film, television, slides, and audiotapes. However, technological innovations will gradually reduce the need for a multiplicity of separate media by providing a combination of electronic-microform system for storing and retrieving both still and motion material with sound.

The trend toward miniatruization of both software and hardware consistently reduces space requirements for housing production resources. Miniaturization also increases the ease with which information can be recorded and retrieved by many individuals under nearly any condition and location.

The classification, storage, retrieval, and distribution of textual, audio, visual, and data resources will be handled by a total information system. Such a system will serve the functions now provided by the traditional library and instructional materials distribution center. It will also provide the techniques and devices needed by the instructional team or teacher to manipulate, organize and structure these "banked" resources into appropriate lessons or courses of study.

Facilities and Spaces

Educational technology is constantly changing with the result that new facilities will be required in different space configurations. Curriculum changes, new teaching methodologies, and new media equipment must be accommodated by new designs, instrumentation, and utilization of building space. Although many of these changes cannot yet be identified, they should be anticipated in future planning.

1. Wherever possible, space should be planned so it is convertible from one use to another.

2. Wherever possible, multi-use space should be provided if it can be designed to serve the specific functions well with a minimal amount of conflict.

3. A variety of learning spaces should be provided, with special emphasis on small group and individualized learning facilities, with the latter being dispersed widely throughout the educational institution. These learning spaces should have direct access to the total information system plus built-in self-contained media systems for the display of learning materials. Adequate attention must be given to environmental factors such as lighting, acoustics, and climate control.

4. A variety of office, work, and production spaces will be required for personnel and the hardware and software of the media resources services. Certain of these functions will be housed in a centralized area. Other media support activities will require space dispersed throughout the educational institution. Most of these spaces must have direct access to the total information system.

Personnel

A comprehensive system of media resources and services will require a large staff of professional and technical personnel. The team concept of preparing learning programs and materials will substantially increase the ratio of educational support personnel to health professionals.

The educational support team will be comprised of a variety of media, evaluation, curriculum, engineering, electronics, computer, and information/communications professionals and technicians.

Goals of Educational Technology

The goals of educational technology are to:

1. Make available to teachers and others concerned with the development of learning resources and related instructional presentations all media, technology, services, and systems required in the educational communications process.

2. Make available to the learner all media, technology, services, and systems required in the instructional/learning process.

3. Establish and make available suitable systems and methods for feedback and interchange between teacher and learner.

Realization of these goals should in all probability place emphasis on the preparation and acquisition of instructional/learning materials related to three developmental phases:

Phase I should focus on the expenditure of funds for the development of instructional/learning programs utilizing such commonly available software as books, film, slides, audiotapes, and related materials. Low cost hardware, such as slide viewers, audio cassette players, and cartridge film devices should be employed as the primary means of student access to these learning programs.

Phase II should focus on improving the accessibility of instructional/learning programs to students at a wide variety of locations through the use of such electronic media as closed-circuit television and dial access information retrieval systems.

Phase III should focus on the automation of information acquisition, storage, retrieval, and distribution employing computer management and microform storage techniques. Interconnection with regional and national information networks will vastly increase the availability of learning resources for integration within the curricula of the medical center educational program.

The degree of hardware sophistication to be implemented during each of these developmental steps should involve a cost-effectiveness analysis of various software/hardware systems combinations capable of supporting educational programs designed to achieve criterion levels of learner performance.

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TESTING AND EVALUATION FOR THE SCIENCES

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Historical Stages of Test Development

Man's attempts to measure what students learn in 'school' may be roughly classified into four major periods. The first period dates from antiquity to about 1800 A.D. The second period encompasses approximately the nineteenth century and includes the development of statistical techniques which were to make possible the standardized testing movement. The third period dates from about 1910 to about 1960. At this writing, there is evidence of a fourth era in testing and evaluation which may result in the development of new instruments in testing and new techniques in evaluation.

When the first formal written examination first made its appearance is unknown, but it is known that China had developed a complex system of national examinations at least as early as 2200 B.C.[1]

Perhaps the earliest record of an ***oral*** examination is that found in the Old Testament (**Judges,** 12:5–7). Scheidemann[2] describes the testing of the Ephraimites by the Gileadites at the passages of Jordan. If the Ephraimite could not pronounce the word "Shibboleth," but instead called it "Sibboleth," he was slain. Today, doubtless we would call this a criterion referenced test or test item.

There are numerous recorded instances of variety of performance tests administered by primitive tribal groups to youths as part of the initiation rites in preparation for entry upon adult status. These performance tests, among other things, required the youth to withstand hunger and thirst, tested his bravery and measured his skill in hunting and fighting.[3]

Records exist of early objective standards for comparing attainments of youth in Greece. Thus, "The test of the development of a Spartan boy was whether or not he could endure hunger, cold, and exertion; the test of the Athenian boy in determining whether he could run, jump, race, declaim, repeat literature, and debate."[4]

The ***written*** university examination apparently was not used by the universities until less than 300 years ago. "Probably the first written examination at a university was in 1702, when it was introduced at Cambridge, England."[5]

In short, man has recognized differences between individuals for thousands of years and accordingly has subjected them to numerous performance, oral, and written tests. As recently as the beginning of the nineteenth century, however, the instruments available for such measurement were crude and unreliable and did not provide very well for comparative purposes. It is the appearance of this ***comparative*** bit that has really gotten us into some silly difficulties as we will see.

"The first examination of historic interest, in our own country, is the Boston examination of 1845."[6] This was a comprehensive written examination made up of 154 printed questions in such subjects as natural philosophy, geography, history, and astronomy. It was administered to

some 530 fourteen year old students in twenty-three elementary schools in Boston. The need for such an examination arose from the increasing difficulty for the Boston school committee to orally examine all the pupils as enrollments increased.

The significance of the Boston examination lies in its impact upon Horace Mann, the American educator who had a great deal to do with the shaping of American education. Mann said: "We venture to predict that the mode of examination by printed questions and written answers will constitute a new era in the history of our schools."[7] How prophetic he was! How 'good' the new era was to be is another question.

The earliest record of any form of ***standardized*** measurement of the results of teaching is less than one hundred years old. Professor E. L. Thorndike reported the development of a scale book for handwriting devised by an English school master, the Rev. George Fisher, of the Greenwich Hospital School in 1864.[8]

In our country the first standardized test of which there was record was developed thirty years later in 1894 by J. M. Rice.[9] Dr. Rice conceived the idea of trying to settle the conflicting claims of school men about the relative merits of various courses of study and study methods. As his first subject, he chose spelling and developed a fifty word spelling test. But he was ahead of his time. ***It is evident that, as late as 1900 the standardized test did not exist.***

As the nineteenth century drew to a close, some developments outside of education were to make possible rapid growth in the field of educational measurement shortly after the turn of the century. Of major significance was the development of statistical methods by Galton. Another significant development which just preceded the interest in and development of standardized achievement tests was the research on mentality and the development of psychological testing.

Thus, the stage was set around 1900 for the third period of growth in testing. The most prominent leader in this education measurement movement after 1900 was E. L. Thorndike who published his first book on mental and social measurement in 1904. Others quickly followed.

By World War I, the basic statistical techniques had been developed and the need clearly demonstrated for the production of better measurement of what schools were accomplishing with their students. By the 1920's so many tests had been produced in so many subject areas that Monroe published a small bibliography of standardized tests for secondary schools. By 1920, the "battle" for educational measurement by means of objective tests had been won. This does not mean the tests were very good because they were not.

But, subsequent to 1920 there developed a tremendous emphasis on the ***quality*** of test construction——and we are still struggling with this one, i.e. how to improve our tests.

A new direction developed in the thirties in educational measurement influenced by Ralph W. Tyler with his work with the Eight-Year Study. Tyler emphasized the concept of ***evaluation*** as contrasted with testing and was concerned with ". . . the measurement of a broader set of objectives (i.e., more aspects of a person's characteristics and response tendencies) than the ordinary achievement tests deal with."[10]

The testing movement had a number of influences on the curriculum, one of which was that if a teacher is to construct a good test, he must be aware of what he is trying to measure, i.e. aware of his subjectives. At least, he ***should*** be aware of his objectives. The objectives needed to be specific and behavioristic instead of vague and glittering generalities.

Since World War II, we may characterize the movement until relatively recently as the period of test batteries and testing programs.

One of the most significant more recent developments in the field of educational measurement was the publication of Bloom's **The**

Taxonomy of Educational Objectives, Handbook I; Cognitive Domain. The function of this taxonomy was to provide a system whereby test items could be classified according to degree of complexity of mental processes required to answer the question.

In short, the half century from 1910 through 1960 witnessed a tremendous explosion in the field of standardized and teacher-made testing. In particular, standardized tests in science and virtually every other field reached a high point in efficiency insofar as what they measured was concerned, but they incorporated a tremendously wasteful idea—and still do.

Permeating most of the standardized tests and spilling off into the teacher-made test was the concept of selection instead of development. The purpose of evaluation became and remains primarily the grading and pidgeon-holing of students in order to 'select out of the system' the unfit. The effects on students at all levels have been devastating. On the one hand there were few saying tests should help diagnose the needs of these persons to help them learn while others were saying the function was, on a comparative basis, to get rid of these students because they were the lower achievers at a given point in time.

When students are evaluated on a normative or curve basis, this places them at swords points with each other, guarantees failure for many aside from any criterion of excellence and cultivates the tendency for students to avoid cooperating with each other.

"As testing and other forms of evaluation are commonly used in the schools, they contribute little to the improvement of teaching and learning, and they rarely serve to ensure that all (or almost all) learn what the school system regards as the important tasks and goals of the education process."[11]

A much broader view of evaluation is emerging today, well described by Bloom, Hastings and Madaus.[12] They see evaluation as encompassing:

"Evaluation as a method of acquiring and processing the evidence needed to improve the student's learning and the teaching.

"Evaluation as including a great variety of evidence beyond the usual final paper and pencil examination.

"Evaluation as an aid in clarifying the significant goals and objectives of education and as a process for determining the extent to which students are developing in these desired ways.

"Evaluation as a system of quality control in which it may be determined at each step in the teaching-learning process whether the process is effective or not, and if not, what changes must be made to ensure its effectiveness before it is too late.

"Final evaluation as a tool in education practice for ascertaining whether alternative procedures are equally effective or not in achieving a set of educational ends."

Little doubt remains today among educators that effective teaching and learning include testing and evaluation. Thus, that student's study habits are modified by the instructor's testing emphasis, either for good or for ill, is well known to most of us. This factor is evidenced in the tendency of students to ascertain how each instructor tests in order that they may know how to prepare for his tests.

If student's study habits are affected by the instructor's testing proclivities, it follows that if the instructor emphasized trivia, the students will tend to study for trivia. Furthermore, to teach without some sort of feedback on the outcome seems to us today to be virtually unthinkable. Feedback is important for students themselves, for the teachers in looking at their own effectiveness, for the teachers in making changes in their teaching strategies and for curriculum makers in revising and updating their programs.

Unfortunately, considerable confusion has grown up about the efficacy of testing at all levels from kindergarten through the graduate school. This confusion derives, at least in part from ambiguity as to the purposes of testing. It derives too from confusion between the very discretely different processes of ***measurement*** and ***evaluation***. Scores earned on a valid and reliable test (measurement) are one thing, while the subjective judgements the teacher brings to bear on the ***meaning*** of these scores as they relate to the individual student, his own teaching, etc. (evaluation) are another.

The purposes of this paper are to point up some of the more crucial concepts which might be kept in mind by veterinary medical educators as they devise, construct and refine their testing programs in their various colleges. More specifically, this paper emphasizes how these crucial concepts relate to the emerging emphasis on mastery learning.

Specific Functions of Testing

Of primary importance is clarity on the functions tests are to perform. While these decisions rest primarily with the curriculum makers and with the instructors, at the vert least these persons should be clear about the functions their tests are designed to accomplish. A number of the more major functions available as options are briefly presented below.

First, when test items or other testing measures are clustered around clearly defined and essential objectives, i.e. around the more significant elements of the curriculum, students tend to concentrate their learning efforts towards these objectives.

Second, careful pre-testing can help the student and the instructor know where and how to begin. Obviously this assist is particularly crucial for young children, but it certainly is helpful in truly individualizing programs in higher education. Typically, however, we begin 'at the beginning,' i.e. by assuming an equal state of ignorance (or knowledge) among all students.

Third, post-testing can document mastery or the lack of it, providing a basis for assessing such factors as teaching effectiveness, student achievement and curriculum modification. When coupled with pre-testing, indications of ***growth*** or ***change*** in students can be detected. Not to be overlooked is the guidance for additional learning that can be gleaned from effective post-testing procedures.

Fourth, interim or formative testing serves a monitoring function enabling both student and teacher together to adjust their efforts to maximize their effectiveness. Such frequent monitoring contrasts with more infrequent summative testing for 'grades' which may serve primarily to induce tension in some students. There is evidence that little or no real motivation results under conditions of considerable anxiety.

Fifth, the development of tests or related criterion measures tends to sharpen and refine the professor's conception of his goals for instruction. More specifically, if the instructor makes up his objectives ***first***, builds his tests ***second***, and only then develops his materials and teaching strategies, he drastically increases his efficiency as well as insuring balance of the program. Contrast the above approach with the more traditional selection of materials ***first*** more or less haphazard choice of test items ***second***, and then, when asked, the more or less 'thinking up' of the objectives! If we know anything about teaching, we know that a sharp focus on that which we are attempting maximizes our effectiveness.

Sixth, the learning function itself served by frequent testing should not be overlooked or minimized. Learning theorists maintain that recall enhances retention. The discovery of correct responses to ***carefully constructed*** objective test items goes beyond simple recognition and involved considerable recall.

Throughout all of the above, the concept of feedback is of extreme import. A simple physical analogy should suffice to clarify this point. For example, the riflemen can only modify his aim for

increased accuracy as he learns about the location of impact of his earlier shots. If we keep this point in mind as we plan and construct our tests and testing procedures we may avoid some of the more common pitfalls which have brought the testing movement into disrepute. Let us examine some of these more common weaknesses in our teacher-constructed tests.

Common Weaknesses in Teacher-Constructed Paper-and-Pencil Tests

One major weakness is the prevelence of testing for low-level primarily memoriter type learning. A study by the author and several colleagues of the mid-year examinations in physics, chemistry, biology and 9th grade science in 100 Virginia high schools revealed the predominant emphasis to be the simple recall of information.[13]

In more specific terms 78 percent of the test items were concerned with the recall of factual information (level 1.00 of Bloom). Of this 78 percent, 64 percent of the items (or 50 percent of the approximately 14,000 questions) required only the simplest form of recall (level 1.10 of Bloom's Taxonomy). If it is assumed that teachers tend to place on their mid-year examinations those things which they consider most important and if it is further assumed, as mentioned earlier, that students' study habits are affected by the teacher's testing habits, then the status of science teaching in the secondary schools of Virginia at that point in time was no less than alarming. Studies similar to the above in the various schools and colleges of our institutions of higher learning might reveal whether there are similarities to this state of affairs

A second major weakness in our teacher-constructed tests consists of a lack of awareness by the instructor of the major strengths, limitations and functions of the different types of tests, test questions and *other testing instruments* and procedures. In the preparation of paper-and-pencil instruments there is a lack of awareness of the specific functions of the essay, multiple-choice, true-false, matching, completion, problem solving and situational or application type items. Mindless debates abound among faculty about whether or not to use such and such a type--missing the point i.e. that the *criterion of use* should hinge upon the instructor's purpose and whether or not a particular type of question enables that purpose. A number of references for the interested reader is suggested in an attached bibliography.

A third major weakness is lack of basic skills in the principles of item writing and of test building in general. Planning, preparing, administering and analyzing tests requires some care and skill. An excellent *free* resource available for the asking is put out by Educational Testing Service entitled **Tests and Measurement Kit**, Princeton, New Jersey, 08540.

Fourth, simple item analysis procedures designed to build pools of effective, discriminating test items clustered about specific objectives are too rarely employed. There is a paucity of skill in the elementary statistical techniques useful in analyzing and improving tests. Coupled with this limited use is a general lack of understanding of basic concepts in measurement such as validity, reliability, correlation, standard error, and the like.

Still another major weakness derives not as much from weaknesses in the tests themselves but in the use of the results. One of the major and most prevalent 'curses' of the testing movement has been the blind application of the normative concept to the summative evaluation of students. Under the typical approach to grading, the normal curve concept is applied which means, by definition, that half of the students in each class will be assessed as doing poorly no matter their level of achievement. The converse is also true. Also, mindless application of this normative concept has, over the years, aroused much fear, tension and hostility in students, while forcing intense competition aside from any particular standards of excellence. The goal has been to do better than the others, whatever that is, and the evidence is that the variance in quality among institutions, among colleges within institutions and among departments within colleges, not to

mention among faculty within a department has been considerable.

If, on the other hand, instructors were to state with precision that which their students are to learn and then to determine whether or not such learning is attained, success becomes defined as reaching the level of mastery established for the objective prescribed and becomes *independent* of what the student's peers do or do not accomplish. This is a major concept in mastery learning as set forth in the work of Block, Bloom and others so more need not be said about it here.

There is evidence too, as mentioned earlier and as Cronbach, Bloom, Block and others have indicated, that the very clear precise specifications of that which is to be learned in behavioral, observable terms at a given level of proficiency under clearly stated conditions is about half of the battle. In such circumstances, tests tend to move out of the guessing game category and truly become assists for student and teacher alike. A major source of suspicion and distrust is removed for the student ne longer has to 'psyche out' the teacher.

Unfortunately, at this stage another problem tends to emerge. This is that the students begin to do too well, i.e. there are too many A's which may bring down on us the wrath of the administration. This is interesting, if not ironic when it is remembered that presumably at least one of the functions of teaching is learning and one of the indictments of effective teaching becomes the accusation that too many of the students are learning too well! But that such is the case becomes all too clear to that faculty member who, having informed his students of exactly what they must master to a prescribed standard of excellence finds himself forced to turn in 27 A's and three B's in a class of 30. One way out of this, of course, in recent years has been to go to a pass-incomplete grading system.

While the tenor of this paper to this point has stressed the use of pencil and paper instruments, the intent is not to suggest that these are the only or even necessarily the most helpful instruments. Increasingly there are research efforts to relate these paper-and-pencil devices to situations involving observable behaviors so that one or the other may be used interchangeably.[14] Additionally, there are many elements of a program which, to date, can only be assessed through direct observation of the student's performance in situations. This leads us to the question of what to measure.

What to Measure

You will hear shortly from Drs. Smith and Gardner regarding the cognitive and affective domains, i.e. the mental and the emotional dimensions of learning so I will only briefly refer to them here. In essence, we tend to stress the cognitive dimensions of learning and slight the attitudinal. And yet, you and I know that success of most of us in our chosen fields depends as much on our feelings, beliefs, opinions, values, attitudes and skills in human relations as on our technical expertise. Who ever was fired because "he did not know" in contrast to "he could not work with anyone——even himself?" I just want to say that progress is being made in assessing the affective domain despite the cultural reluctance in America to stepping into what is commonly assumed to be one's own private business.

Not only must 'what to measure' move over into and include dimensions of the affective domain but, increasingly we must raise the level of measurement in the cognitive domain from the heavily memoriter or recall to increasingly insist upon ability to apply, analyze, synthesize and evaluate as suggested by Bloom and others.

Improving One's Testing Program

A number of alternatives exist in considering how to improve one's program of testing and evaluation. Basic to all such attempts, however, is the necessity for faculty to learn how to write objectives clearly and well and for faculty to have a few hours of basic instruction in the principles of testing and evaluation.

A sound next step then is for assessment procedures to be developed including pools of test items clustered about objectives. With some cooperation and coordination among professors at various institutions working in similar subject areas, each professor would not need to rediscover America.

It has been possible for some time now for the statistical analysis of our test items to be handled through a computer including item analysis, reliability and validity.

Increasingly, the generation of the tests themselves, particularly the paper-and-pencil variety, is accomplished through item pools as needed. Each faculty seriously interested in improving its testing program needs a person qualified in these areas to organize and implement it in collaboration with the faculty.

But, and this is probably the major point of 'where we might go.' The modern evaluation program stresses ***formative*** evaluation procedures, i.e. systematic evaluation ***during*** the processes of curriculum development, of teaching and of learning in contrast to only ***summative*** evaluation at the end of a course or term or program. In summative evaluation, you judge ***afterwards*** and not ***during***. This is a crucial difference. It changes the entire concept of evaluation from one of selecting out to one of enabling a person to figure out how to stay in. It becomes a rewarding, helpful process instead of a punitive negative one.

In summary, I have endeavored to briefly trace the history and major trends of evaluation over the past few years. Certainly, it is a sketchy attempt in the brief space allowable, but hopefully you have at least a fuzzy idea of whence we have come and where we are.

FOOTNOTES

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PROFESSIONAL ASSESSMENT–COGNITIVE DOMAIN

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INTRODUCTION

At this stage of the symposium participants should have developed their minicourse. Topics have been chosen, objectives have been stated, and media for presentation have been selected. The final stage is the conversion of objectives to evaluation situations. My task for this session of the symposium is to deal with the cognitive evaluation of students with an emphasis on what's new in evaluation. As a starting point I would like to discuss briefly what I will label the "traditional" approach to student evaluation. This traditional or usual approach for testing students will then become my "straw man" for the remainder of the paper.

The first characteristic of the traditional approach is the behavior students exhibit while preparing for course examinations. Preparation often becomes a guessing game students play to "psyche out" the instructor in an attempt to find out what is important.

The second sign of the traditional approach is a preponderence of test items that ask for memorizing specific facts and terminology and the avoidance of items testing comprehension and application.

Yet another characteristic is an emphasis on spreading student's test scores so that A's, B's, C's, D's and E's can be easily assigned. This is often accomplished by asking increasingly pedantic questions taken from isolated bits of information used as filler for examination purposes. In other words, an attempt is made to distribute students on some approximation of a normal curve.

Finally, the traditional approach is characterized by the use of tests as unidirectional assessment devices administered at the end of the learning situation. By unidirectionality I mean that tests are usually given by instructors to assess student competency with little or no thought given to the evaluation of the instructional process and teaching effectiveness. Seldom is the assessment process used to give feedback for the improvement of instruction.

CRITERION–REFERENCED TESTING

In contrast to the traditional approach to assessment is what has been termed "criterion-referenced testing." This approach attempts to indicate with as much precision as possible, the degree to which each student has mastered the learning objectives specified in a course or unit of instruction. Criterion-referenced testing is, of course, a direct consequence of the learning by objectives approach.

From Objectives to Evaluation

> The process of measurement is secondary to that of defining objectives. The ends to be achieved must first be formulated. Then measurement procedures can be sought as tools for appraising the extent to which those ends have been achieved.*

The ability to contruct meaningful and valid assessment devices is to a large degree dependent upon how well performance objectives have been specified. Well written objectives, which spell-out

*Nunnally, J. C. **Educational Measurement and Evaluation,** New York: McGraw-Hill, 1964.

in an explicit manner the behavior you wish the student to demonstrate, go a long way in assuring the construction of useful testing instruments. Vague and nebulous objectives make test construction difficult and leave the student guessing as to what is expected of him. Recently an instructor was asked to specify the objectives of his course in preventive medicine. The following objectives were given in reply.

1. Create conditions which develop in the student the comprehension that an holistic concept of disease is essential for understanding and correcting problems.

2. Emphasize factual information related to the environment as it applies to alteration or effect on the host.

3. Demonstrate the utilization of facts and principles to the understanding and solving of the problems of community health in lower animals and man.

These three examples are too vague and general to be considered useful learning objectives. Even though they can be viewed as goals upon which further planning might be based, they cannot be tested directly and therefore do not make very useful objectives. You cannot directly test a student to determine if he has a "holistic concept of disease" or if he can "utilize facts and principles," unless these states are defined operationally. What is needed is a number of direct behavioral learning objectives and questions which collectively can be used to reliably infer whether or not the student has the above mentioned capabilities.

Contrast this with the following objective:

> **Objective:** The student should be able to recognize the physiological functions and associated organs that may be involved in loss of control as a result of injury to the sacral vertebrae.

This instructional objective is stated precisely and specifies what the learner must be able to DO when he is demonstrating his mastery of the objective. When objectives are stated in this manner, the construction of test items becomes a relatively easy task.

> **Question:** Injury to the sacral vertebrae often results in loss of control of _____ which is an added danger to the animal's recovery.
>
> a. Bladder and kidney function
>
> *b. Bladder and bowel function
>
> c. Bowel and stomach function
>
> d. Most motor function in rear limbs
>
> e. Most sensory response in rear limbs.

Dr. Dwight Bennett of Purdue is economical in writing objectives and test items in a second example:

Objectives

I Identification of Parasites

Parasite	Be able to identify by	Information Given
Fasciola Hepatica	a. whole parasite grossly b. whole parasite mounted on microscope slide c. section of parasite in liver (microscopic) d. damaged, cirrhotic liver (suspect)	Liver of ruminant
Dicrocoelium dendriticum	a. whole parasite grossly b. whole parasite mounted on microscope slide c. section of parasite in liver (microscopic)	Liver of ruminant
Fascioloides magna	a. whole parasite grossly	Liver of ruminant
Paramphistomum cervi	a. whole parasite grossly b. whole parasite mounted on microscope slide	Rumen OR Reticulum OR feces from ruminant

Questions:

A. Identification

(1 pt.) 1. From abomasum of a calf

Genus _____

(1 pt.) 2. From small intestine of a lamb

Genus _____

(1 pt.) 3. From liver of a sheep

Scientific name_____

The above instructional objectives are stated precisely and specify what the learner must be able to DO when he is demonstrating his mastery of objectives. Too much cannot be said for the importance of good learning objectives for the valid assessment of students' knowledge. When used properly they can aid the instructor in teaching, make clearer to the student what is expected of him and have exams more accurate measures of student learning.

Testing Higher Level Cognitive Outcomes

If instructors were to survey their examinations, many would find that the items included in their tests are predominantly recall questions with few of the items aimed at testing comprehension and application. True, the study of medicine dictates that a great deal of the student's time be spent in learning specific facts and principles, but this should not exclude the instruction and assessment of comprehension and application of medical principles.

The brochure explaining the Symposium lists as one of its objectives the following:

> **Objective:** Participants will be able to ***list*** the three criteria for an educational objective as described in **Preparing Instructional Objectives** by R. S. Mager.

A possible test item for evaluating his objective might look like this:

> **Question:** List the three criteria for an educational objective as described by Mager.
>
> 1. _____
>
> _____
>
> 2. _____
>
> _____
>
> 3. _____
>
> _____

It is possible that participants may be able to ***list, recall,*** or ***underline*** the criteria for an educational objective and still not be able to understand or apply the concept of an educational objective. Hopefully, individuals taking part in the symposium would, upon completion, be able to comprehend the criteria for an educational objective and put their knowledge to work in situations that are new to them. If this is the case, then objectives and test questions should reflect the need for understanding and application of performance objectives.

> **Objective (Comprehension):** Given a list of performance objectives, participants will be able to ***identify*** educational objectives which meet the three criteria described in Mager's book (a 90 percent level of proficiency is required).

> **Question (Comprehension):** Which of the following educational objectives meet ***all*** three of the criteria described in Mager's book?
>
> 1. Given a set of 10 or 15 small numbers (8, 14, 9 etc.), the student should be able to calculate, by hand, the mean or average for the set of scores. No errors will be allowed and the answer will be rounded to two decimal places.
>
> 2. Without the aid of a flotation device the student will swim the side stroke for 200 yards in less than 10 minutes.
>
> 3. The student should be able to understand the concept of homeostasis. Proficiency is defined as getting 80 percent on an objective test.
>
> - - - - - - - - - - - -
>
> 20. Given an adult human skull the student should be able to name and locate the eight bones of the cranium and the 14 bones of the face with no errors (two spelling errors will be allowed).

The above objective and question demand more than simple recall of facts. Participants must be able to show an understanding of the concepts of educational objectives by identifying or recognizing objectives that meet the criteria specified in Mager's book.

> **Objective (Application):** Given that a minicourse topic has been selected, participants will be able to demonstrate their knowledge of performance objectives by

constructing objectives for that minicourse which meet the three criteria described in Mager's book. This should be completed before entering the morning session on June 20th.

Question (Application): Before entering the morning session on June 20th, write below your minicourse topic the objectives you have developed for it. Submit them at the door for appraisal.

Here the participant is expected to demonstrate his knowledge of performance objectives by applying these concepts on some meaningful task. At this point, one is reminded of the last line of the Chineses Proverb printed on the brochure, "I do = I understand."

Warning should be given that the tendency to write lower level cognitive test questions may also carry over while attempting to write learning objectives. Because test questions are derived from learning objectives, care should be taken to avoid writing objectives that demand only simple memorizing and recall.

Spreading Students (Why not to)

Many teachers are happy when, at the end of the quarter or semester, students' cumulative test scores are extended over a wide range. They are even happier when so-called "natural breaking points" appear in the distribution. With a wide range of scores accompanied by "natural breaking points," the instructor can assign grades with relative ease and feel confident that he has fairly evaluated students' performance in the course. This attitude has been supported by traditional testing theory which says that a good examination is one that contains questions having "item difficulties" (percentage of examinees who miss the item) of approximately 50 percent.

With the concepts of learning for mastery and criterion-referenced testing, the emphasis changes from one of spreading students along some continuum to one of assuring that each student has mastered the material. Each question attempts to test a relevant concept and students are expected to exhibit proficiency on one unit of instruction before going on to the next. This often means that students are required to be examined more than once on a particular unit. A second, third or even fourth trial may be needed for some students to learn the material well enough to show mastery on the quiz or test.

Formative vs. Summative Evaluation

Traditional assessment of students usually occurs two or three times during a period of instruction with the primary purpose being the assignment of grades. This final or summative evaluation of student progress can be contrasted with what has been termed "formative evaluation." Formative evaluation is an ongoing assessment process in which evaluation instruments are applied throughout the course of instruction. Results are used as immediate feedback to both the student and the instructor as to how well they are doing. Students obtain information as to how well they are progressing on the learning objectives and teachers can assess whether instruction has been properly designed and conducted. Continual feedback to the student is especially important for those learning situations where successful mastery of the material at one level is to some degree dependent upon mastery of previous material at some lower level. In terms of the "minicourse concept," this means successful completion of one unit of study before progressing to the next.

A final grade of B or C gives little or no useful information to the student as to his strengths and weaknesses, whereas immediate feedback or knowledge of results as to how well he is progressing on the objectives, has the effect of not only facilitating learning but of motivating the learner.

Educators have long maintained that how well a student does on an examination is as much a reflection on the quality of instruction as it is on the student's knowledge of the material. With formative evaluation the instructor is allowed greater latitude in measuring the effectiveness of his program. Was the course and its objectives made clear? Did the various components of the instructional unit adequately convey the

knowledge that was intended? These are questions that can be answered using formative or ongoing evaluation.

Summary of Criterion Referenced Testing

The first and by far the most important aspect of criterion referenced testing is that each test item should be directly associated with a specific objective. The better the objective the easier it becomes to write acceptable items. The second concern discussed was the need to construct items that test more than simple memorization of specific terminology and facts. Examinations should contain questions that test the higher order objectives of comprehension and application. Next, the purpose of teaching is to transcend the normal distribution. The instructor's ultimate goal should be to have each student eventually show mastery of the specified objectives by passing all or nearly all of the test items used to infer mastery.

Finally, assessment should be an ongoing process which allows for continual feedback to both the student and the instructor as to how they are doing. In terms of the minicourse concept, evaluation should take place immediately following the unit of study or better yet, the testing activity can be built into the instruction itself.

PLANNING AND CONSTRUCTING EXAMINATIONS

The aim of assessment is to construct evaluation instruments that determine whether students have sufficiently mastered the material. Weaknesses in tests can be grouped into two broad categories:

1. Students may have achieved the objective but the test questions may not measure that mastery.

2. The student may answer the questions correctly, yet not have mastered the material.

As an example of the latter weakness, without any knowledge of the subject matter, I was able to score 22 correct out of 25 true-false items on a core course exam by applying just one of the rules of true-false test construction. Well constructed items and good testing procedures help assure that students' knowledge is being validly assessed.

Following are some of the concepts and guidelines used for constructing and evaluating classroom examinations. I have chosen to focus primarily on those problem areas that have come to my attention while working at the Office of Veterinary Medical Education at Ohio State University.

Validity and Reliability

Any discussion of testing or test construction must include the concepts of validity and reliability.

The concept of validity simply means "does the test measure what it is supposed to measure?" The primary concern of classroom achievement tests is "content validity." Does the test measure the students' performance on some relevant set of tests? Unlike other types of validity that can be checked statistically, content validity is studied and judged by those who know the content by "eyeballing" or checking the test items against the content supposed to be measured in a particular course of study.

The best procedure for assuring content validity is to set up instructional objectives (discussed previously), and to outline the material presented in class. This allows the instructor to develop a "test plan" that covers fairly the material presented in class. If two weeks out of a five week test period is spent on a particular subject area or if a team member is given a certain block of class time, then a representative portion of the exam should direct itself toward that particular area. One complaint often received from students concerning classroom tests is that considerable class time is spent on an area which is then only sparcely covered on the exam. The instructor should select items that representatively sample the content of material covered in class.

Reliability tells us how much confidence can be placed in our measuring device. It is an index or estimate of the ability of a test to measure performance consistently. If a test is highly reliable then students would be expected to obtain similar scores on a similar test covering the same content area. The primary concern of reliability salient to mastery testing is the length of the test. If in testing students on a particular subject we could ask all the possible questions covering all the material presented in the course we would have an exact index of how well each student had mastered the material. Because of lack of time and energy this is not possible, so the instructor must select a sampling of possible test items to be given as the classroom exam. The importance of lengthening a test is that the more questions asked (assuming all items have content validity), the more adequate the sampling of all possible questions. By asking more questions the instructor comes closer and closer to estimating the student's true accomplishments or achievement. Instructors should take full advantage of the time given to testing to reliably assess the students' achievement. This is especially true for summative or final evaluation. Although a test should be as long as possible within the given time constraints, time should always be allowed for all or nearly all of the students to complete the exam.

Frequency of Examinations

Formative assessment as an ongoing process has already been discussed. It was pointed out that frequent formative evaluation provides feedback to the student as to whether he has mastered the unit objectives or if he still has deficiencies to overcome. Quizzes can be given at the end of each unit, or self assessment questions can be built into the unit much like programmed instruction. A combination of these two approaches is probably best for formative evaluation.

The instructor is still faced with the problem of assigning grades at the end of a period of instruction. This summative evaluation is usually accomplished by administering one or more midterm examinations and a final test. Scores derived from formative evaluation may or may not be combined with summative scores for the assignment of grades. My own feeling is that the quiz scores used to determine mastery should be included when assigning grades.

A possible testing program might incorporate the following steps:

1. A series of questions interspersed throughout the program to be used for feedback of student progress through the unit. These items would be for self assessment and should have no effect on the student's course grade.

2. Upon completion of the unit, the student would be provided with a set of practice of self study questions. Students doing poorly on these questions may want to review parts of the unit, while a good score would signal readiness to take the unit mastery quiz. Again, these items would be for self assessment and would not affect grading.

3. A short test or quiz would be given at the completion of each unit with the results being used to infer unit mastery. If the student exhibits mastery, then he would be allowed to progress to the next unit of study. If, however, he failed to show mastery, he would be expected to return to the instructional program, correct the gaps in his knowledge and try the unit mastery quiz again. When scores on these unit mastery tests are to be used along with summative examinations for grading purposes, only those scores should be used where the student showed mastery. In other words, if the student failed the first quiz but learned the material and passed the second quiz, then the recorded score should be the second exam.

4. Summative evaluation would be the final step in the testing program. This would usually involve the use of test items covering several units of study or final examinations covering all units in the course. The primary purpose of this kind of testing is the assignment of grades.

With the possible exception of the first step, all questions should be taken from the same universe of possible questions. Summative evaluation questions should be basically the same as mastery quiz questions and both should resemble practice questions.

Proficiency Levels for Mastery

The ideal of instructional objectives and learning for mastery is that all the students learn all of the material and hence pass all of the items on the exam but for various reasons complete mastery is often difficult to obtain. Objectives may not be completely clear, the instructional program may be lacking or test items may not validly assess the students' knowledge. For these reasons, mastery on a quiz or examination should seldom require scores of 100 percent. This is especially true for the first few assessment efforts. But, as the instructor obtains feedback and is able to improve his objectives, instructional program and assessment devices, test instruments will more validly and reliably measure near the 100 percent mastery level and can be scored accordingly.

Item Analysis and Feedback

Recently, I aided an instructor in developing a pre and post test for assessing achievement in a continuing education short course. As was expected, all participants showed improvement from the pre to the post test but an item analysis of the examination revealed that on some of the items participants had shown a reversal in learning. That is, they had started the course knowing some of the basic concepts but had been confused during the course presentation. It does not take a great deal of insight to conclude that some aspects of the instructional program are in need of improvement.

Test item difficulty information can be used in at least three ways:

1. Feedback for the improvement of the instructional program can be used to help pick out poor test items. What often happens is that when all or nearly all of the students do exceptionally poorly on an item, it is not because all have equally mastered the material but that there are problems inherent within the question such as ambiguous wording.

2. It can be used to point out those students who are in need of remedial training.

3. It can give the instructor information concerning his attainment of instructional objectives. By looking at the different item difficulties an instructor could determine if the students were grasping the concepts being tested. If they were not, then he should possibly reiterate those concepts.

It would probably be appropriate at this time to discuss the practice of using old test items. The available literature on this subject is scarce but most testing experts generally agree that it is good practice to develop an extensive pool of good test items that can be used again. This does not mean that old tests should be reused in their entirety; this is bad practice and should always be avoided. What it does mean is that teachers might possibly take good questions from exams and keep a file of them for future use. One useful procedure for doing this is to keep a record of test questions on index cards. The test question and possibly the objective is put on one side of the index card and other pertinent information such as "item difficulty" and "date given" on the other side. These item banks can be categorized into different subject areas which aid the instructor in assuring that his tests adequately sample the content covered during instruction.

Writing Essay Tests

Most experts on test construction shy away from using or suggesting the use of essay tests even though they seem to have distinct advantages in certain situations. Testing recall rather than recognition, testing higher-level mental processes, (e.g., reasoning, inference, problem solving) and testing originality or creativity are some of the presumed advantages of the essay test, but critics of the essay test usually conclude that its bad points far outweigh its good ones. Their

contention is that objective tests, if properly constructed, can test recall, creativity and higher mental processes as well as essay examinations and can do it much more reliably and fairly at less cost.

Because the essay test does seem to have certain advantages and because it is often used and will no doubt continue to be used, some of its shortcomings along with some ideas on how to improve essay tests by minimizing these problems will be reviewed. Some of the essential characteristics of the essay examination are:

1. The student organizes his own answers, with a minimum of constraint.
2. The student is required to produce the answer rather than merely to recognize it.
3. The student must integrate ideas and facts into a coherent whole.
4. The student uses his own words and ideas.
5. He answers a small number of questions.
6. Answers can be of all degrees of correctness.

In these characteristics lie both the strengths and weaknesses of the essay examination.

Reliability of Essay Tests. The number one problem of the essay test is consistency of measurement (scoring). Numerous studies have shown that scores or grades obtained at one point in time on essay exams seldom coincide with scores or grades on the same exam scored at another time. In these studies the instructor usually grades a set of nameless exams and then waits a few months until he has forgotten the scores, then he regrades the exams. Seldom are the same scores obtained and usually there are gross differences between the scores obtained in the two settings. The problem of reliability becomes even more evident when different instructors (equally qualified) grade the same set of exam papers.

Another reliability problem is that essay tests allow time for only a limited number of items.

> The time required to answer a single question makes it impossible to include more than five or ten questions in even a fairly lengthy test. This tends to result in what we might call a "lumpy" sampling of what the student knows. We sink four or five big shafts into the mine of knowledge that the student possesses. If these happen to hit pay dirt, the student does well, but if they hit the gaps in his knowledge, he does poorly. With this small number of samples, chance is likely to play a relatively large part. We may get a very unfair sample of a particular student's knowledge.*

One final problem with the essay test is that scores are sometimes partly dependent upon verbal fluency and handwriting ability. A student who expresses himself well and has good handwriting will usually get a better grade than his counterpart who may know the material just as well but lacks those qualities.

Construction of Essay Tests. Following are some guidelines for use in constructing essay examinations.

1. If possible make up the questions a few weeks in advance, set them aside and then go back and review them before final preparation of the exam. This procedure forces the instructor to put some thought into his questions, doing away with off-the-cuff test construction. It also allows the instructor the opportunity to look at the questions from a different perspective. Often questions that seemed clear at the time of writing are vague and inadequate when reviewed.
2. Have other instructors or team members review the questions. This, like the procedure above, allows for a pre-test of the questions. Too often the instructor has in mind what the question and answer should be, but another expert looking at the question may not know exactly what is expected, let alone the student taking the exam.

*Nunnally, J. C. **Educational Measurement and Evaluation,** New York: McGraw-Hill, 1964.

3. Several questions of short length are preferable to a few questions of somewhat longer length. As was pointed out earlier, one of the problems of essay tests is that they may not sample the student's knowledge representatively. More questions allow for the valid sampling of the student's content of knowledge by covering more of the course area. Shorter questions also have the effect of causing the instructor to write more precise questions.

4. Time is a key factor in essay test administration. Often essay tests are too long, sampling such a wide content area that the student doesn't know what is expected of him. Probably the main reason for broad all-encompassing questions is that the instructor is "unconsciously trying to compensate for what he vaguely realizes is inadequate coverage of the content to be sampled." With short, precise and well worded essay tests the instructor can gauge the time needed to answer the questions and allow that adequate time be given to complete the exam.

5. Another principle related to the one above is the use of clear terminology. This rule seems obvious, but it is often one of the primary problems with essay examinations. The question itself should be written as simply as possible. The answer to the question might call for specific terminology, definitions etc., but if reading and understanding the question is contingent upon a high degree of specific knowledge, then the examiner is curtailing his ability to find out how well the student knows the material. If the purpose of the test is to find out if the student knows the meaning of specific terminology then it would be better to use an objective test rather than an essay format. If the written question necessarily calls for such terminology, then it should be explained or defined in the question itself.

   In short, essay questions should be stated in terms that *all* students can be reasonably expected to understand, so that all can respond fairly to the questions.

6. Although subject to a great deal of controversy, most test experts would agree that all students should take the same exam. Students should not be offered a choice of questions to be answered. An example of this, often used on essay exams, is "pick three of the five and answer." This procedure reduces the ability to compare student responses and adds one more source of variability to the subjectivity and inaccuracy already existing.

7. The words "what do you think," "in your opinion," "write all you know about ____," or "Discuss" almost never belong in an essay question to measure academic achievement. It is often very difficult for the student to determine just what kind of a response is wanted when questions are phrased in this manner. These and similar phrases usually result in the student writing in some more or less aimless fashion until his time is up. The only time the use of such questions as "What do you think" and "In your opinion" is justified is when you want to know individual attitudes.

8. In general, start essay questions with such phrases as "Compare," "Contrast," "Give original examples of," and "Explain how or why." These words will help to present tasks requiring the student to select, organize, and apply his knowledge. It is usually best to avoid starting essay questions with such words as "what," "who," and "list." These words are likely to present tasks requiring only the reproduction of information.

Following are some suggestions for evaluating essay tests:

1. The instructor should prepare a tentative scoring key at the time of the construction of the test. This will improve the objectivity of the scoring so that he will not have to rely on vague generalized impression while scoring. Preparation of a key also has the effect of revealing weaknesses in the structure of the questions that can be corrected prior to administration.

2. Before final scoring of the essay exam begins, several of the papers should be read with the tentative scoring key kept in mind. This acts as a check on the adequacy of the scoring key by determining if other answers or approaches are possibly as feasible. This may lead to an alteration of the scoring key before the actual scoring of the exams.

3. Read all the answers to one question before going on to the next. The procedure allows for a more objective comparison of answers and reduces what is called "halo effect," or the tendency for the answers written on previous questions to contaminate the judgement of the question presently being scored.

4. Papers should be graded anonymously. Not knowing the name of the individual increases the objectivity of the grade given. One suggestion is that the name of the student be placed on the back of the exam.

5. The instructor should periodically recheck papers graded earlier to ensure that standards have not shifted. An occasional check of papers assures that all students are being graded using the same standards.

Summary of suggestions for essay test construction:

1. Make questions up a few weeks in advance of the exam and review them before final preparation of the test.

2. Have other instructors and team members review the questions.

3. Use several short questions rather than a few long ones.

4. Make sure time is allowed to finish the exam.

5. Use clear and simple terminology in writing the questions.

6. Don't offer a choice of questions to the students. All students should take the same exam.

7. Avoid the words "What do you think," "In your opinion," "Write all you know about," or "Discuss."

8. Start essay questions with such phrases as "Compare," "Contrast," "Give original examples of," and "Explain how or why."

Summary of suggestions for grading essay tests:

1. Prepare a model answer in advance.

2. Read several of the papers before scoring is begun.

3. Read all the answers to one question before going on to the next.

4. Grade papers anonymously.

5. Periodically recheck papers graded earlier to ensure that standards have not shifted appreciably.

Writing Objective Tests

Tests whose answers are definite, precise and leave little or no room for subjective interpretation are usually branded as objective tests. These exams can usually be scored by clerical help or machines as well as by the individual who constructed the exam. Objective tests include such item types as true-false, multiple choice, matching, and fill-in-the-blank.

Experts in test construction make the claim that just about anything can be tested objectively if enough time and effort are exerted in preparation of the items. They also profess that objective tests can measure anything that can be measured by essay or oral testing and that it can be done much more effectively.

Some important characteristics of objective tests should be noted.

1. **Reliability.** Whereas essay examinations are often unreliable due to scorer inconsistencies, objective exams usually eliminate this source of error.

2. **Scoring Economy.** One very good reason for using objective tests and becoming proficient in their construction is that as the number of students per classroom increases it becomes more and more difficult to use anything but objective tests. With many students it becomes almost impossible to grade essay examinations reliably or economically. Objective tests can be graded using clerical help or can be machine scored in a very short time. This rapid return of results to the student has the added advantage of increasing the learning of the students.

3. **Adequacy of Content Sampling.** The greatest virtue of the objective test is that it has the potential for adequately sampling the entire subject-matter content. With four or five essay questions it is difficult to cover the material completely so that a student's score is often dependent upon whether or not the instructor happens to hit his strong areas. With an objective test of 60 or 70 items covering the entire content of the course, an instructor can have much greater assurance that he has identified students along the continuum of knowledge of course material.

Some general guidelines of objective test construction will be listed, followed by specific suggestions for writing different types of objective test items.

General Guidelines of Objective Test Construction

1. Unless you are testing reading ability or vocabulary, the reading difficulty of the test items should be kept low. All the students should be able to understand the question even if they don't know the answer.

2. Do not lift a statement verbatim from the textbook. When a student sees verbatim statements on a test, he often put on the defensive about test taking and it reinforces his idea that a student has to memorize the text in order to be a successful student.

3. Start the test with a few easy questions--taking an exam can be a harrowing experience for some students. A couple of relatively easy questions at the beginning of the exam often have the effect of easing a student's test anxiety, thereby enabling him to do his best on the exam.

4. If an item is based on opinion or authority, indicate ***whose*** opinion or ***what*** authority. Students, especially the more able ones, often know of conflicting opinions on different concepts and problems. Pairing the name with the question eliminates this potential confusion.

5. In planning a set of items for a test, take care that one item does not provide cues to the answer of another item or items.

6. Avoid the use of interlocking or interdependent items. These are questions where answering or understanding one item is contingent upon correctly answering or understanding another item.

7. Positioning of correct responses or alternatives for objective tests should occur as randomly as possible. Teachers should avoid following patterns of correct responses or using one of the alternatives more than the other. The tendency to "hide" the correct choice in the middle of the alternatives is an example of this problem.

8. Instructors should avoid trick and catch questions. These questions tend to put students on the defensive about test taking. They also give an edge to students who don't know the material and so just randomly select an alternative as being correct while the prepared student makes the wrong response.

9. Avoid ambiguity in questions. This rule sounds analagous to a politician saying he is for peace, economic stability, justice for all, and mom's apple pie. It is an objective just about as hard to achieve. One way, discussed earlier, of assuring clarity of questions is to have other instructors review the test and make comments.

10. Beware of items dealing with trivia. This is a common fault with most classroom achievement tests. The primary reason for this is that pedantic items are much easier to write than problem solving, reasoning and inference questions, which are difficult and time consuming to construct. The writing of good, valid questions can be greatly facilitated by keeping the course objectives firmly in mind.

True-False Items

True-false items are one of the more familiar types of objective test items. They have many inherent problems, a few of which are listed below.

1. There is often a tendency for the instructor to take verbatim statements from a textbook, thus encouraging the student to study by rote memorization of the material.

2. Students often feel that true-false items do not test what they actually know or can do.

3. True-false items often picture the world as black or white and not as possibilities on a continuum.

4. Because there are only two alternatives to each question some students do much better than others simply because chance plays a proportionately larger role.

5. It takes significantly more questions to make a true-false test as reliable as a multiple-choice exam.

6. The biggest objection to true-false items is that they are extremely difficult to write. As often as not, subtle hints within the question reveal the answer without the student having to know anything about the concept being tested.

Following are some cautions to be observed in writing true-false items:

1. Attempt to make each item unequivocally true or false. Often the students who know the most about the subject area have the hardest time deciding if the item is ***always*** true.

2. Beware of words or phrases that give cues to the probable answer. Statements that contain "all," "always," "no," and "never" are so all-inclusive and represent such broad generalizations that they are likely to be false. Statements involving such items as "usually" or "sometimes" are usually true. These cues are referred to as "specific determiners" and should be avoided in test preparation.

Examples

T *F* The choice of the route of administration is dependent ***only*** on the ease of accomplishment.

T *F* Biologics are ***always*** dosed per pound of body weight.

T F Oral administration is ***usually*** the safest route.

3. Beware of ambiguous and indefinite terms such as "frequently," "greatly," "to a considerable degree," and "in most cases." These terms mean different things to different people.

4. Negative statements should be underlined. Students hurriedly taking an exam often miss negative statements.

Example

T F Pulse rate in the dog is *not* as important as in man.

5. Beware of giving cues to the correct answer by the length of the item. True statements are generally longer than false ones.

In summary, good true-false test items are extremely difficult to write, less reliable than other approaches, and often do not measure what they are intended to measure. Instructors should avoid using true-false items whenever possible.

Short-Answer and Completion Items

Following are some short maxims concerning completion items, followed by an example of a good completion test item.

1. Beware of indefinite or "open" completion items where any number of words or phrases may be reasonable and factually correct.
2. Omit only the key words.
3. Leave as few blanks in the statement as possible.
4. If at all possible put the blank or blanks at the end of the statement.
5. When the problem requires a numerical answer, designate the appropriate units to be expressed.

Example

Questions 5–9 ask you to choose among five species of animals.

Answer as follows:
(a) dog
(b) cat
(c) horse
(d) cow
(e) sheep

5. The highest erythrocyte count is normally seen in the _____.
6. The most rapid sedimentation rate is normally seen in the _____.
7. Myelogenous leukemia is seen most often in the _____.
8. Reticuloendotheliosis is described as an important disease entity in the _____.
9. Of the diseases of the leukosis complex, the lymphogenous form is seen in over 99 percent of affected animals in the _____.

This question has the advantage that it can be machine scored. Most often, however, teachers use these items so that the student is forced to recall the answer. If this is the case then the list of possible alternatives would be eliminated.

Matching Items

Matching questions are much like multiple-choice questions except that instead of a problem followed by four or five possible responses, matching questions have several problems with several possible answers taken from one list. Following are some maxims on writing effective matching items:

1. Items in a set should be homogeneous. That is to say that all of the items should bear some relationship to each other. If they do not then it usually becomes relatively easy for the student to eliminate many of the alternative responses. An exaggerated example of this would be to incorporate biometric and anatomical items in the same matching question. Responses such as chi-square, t, F, etc. could quickly be eliminated from an anatomical phrase stem.
2. The number of answer choices should be greater than the number of problems presented. This increases the probability that

you will be assessing the student's knowledge and not his ability to use the process of elimination of alternatives. If for example a set of matching items consisted of four problems and four answer choices and a student only knew two of the four answers he would still have a fifty-fifty chance of getting the entire set correct. An exception to this is when the answer choices can be used more than once.

Example

Match the following gestation periods on the right with the animal on the left.

Cow _____	A.	86
	B.	113
Horse _____	C.	146
	D.	187
Pig _____	E.	224
	F.	280
Sheep _____	G.	335

3. The number of items in a set should be kept relatively short. This facilitates keeping the items homogeneous and makes it easier for the student to find and record his answers.

4. Response options should be listed in some kind of logical order. An example would be putting names in alphabetical order or quantities in ascending or descending order.

5. The directions for matching questions should be clear and indication should be made as to whether an answer choice may be used more than once.

Multiple-Choice Items

These types of items are used more in classroom and professional testing than any other objective type approach. If well constructed they can be used to test most problems including those that require a great deal of insight, understanding, creativity, and thought as well as simple recall. Because their flexibility is greater than other objective approaches they are preferred in most situations. They also have the added advantage of being more reliable than many other objective measures because they provide several possible options or alternatives.

Following are some suggestions for writing items and their accompanying alternatives.

The Item as a Whole

1. The item should contain a central theme or thought. If the student has to read the answers in order to know what the question is, then the question probably lacks a central theme.

2. The item should be expressed in clear and precise language. Here again, this is probably easier said than done but clarity can be facilitated by having others review the questions or reviewing your own questions after a suitable time lag from the time of original test construction.

3. The question should be as short as possible and still give all the needed information. Teachers often feel compelled to tell the student something in the question even if it has no bearing on answering the question. This only takes more time and confuses the student.

4. Whenever possible, questions should be stated in positive form. Negative questions have three common faults. One, they are usually easier because the resultant answer is often obvious; two, they are disturbing to the student who prefers to indicate best answers rather than poor or unacceptable solutions; and three, they are often overlooked when students are hurriedly taking an exam.

5. The stem of a multiple-choice item should clearly formulate a problem. All of the alternative responses should be possible answers to a single problem.

6. As much of the item as possible should be included in the stem. This enhances the clarity and readability of the problem.

7. Beware of double negative statements. They are difficult to read and confusing to the students. Following is an example of a double negative question which was confusing to many students. The correct response is "b" but roughly half of the students marked "e" as the correct response because it was a ***correct statement,*** but they had forgotten or became confused on the introductory statement which said "In the following statement which of the 5 choices is incorrect." In brief, half the students knew the answer but missed the question because of poor wording.

Example

(In the following statement which of the 5 choices is incorrect?)

Atelectosis may ***be present*** as a result of

a. Insufficient production and/or supply of pulmonary alveolar surfactant
*b. Filling of the alveoli with exudate
c. Compression of the lung due to pneumothorax
d. Occlusion of a bronchus supplying the atelectatic portion of lung
e. One of the above statements is incorrect

1. All the alternatives should be plausible from the statement of the problem. Not only should the incorrect alternative(s) be reasonable but care should be taken to assure they also follow grammatically from the question. If the stem and the keyed answer sound alike while the alternatives do not, then the student may answer the question correctly without actually knowing the answer.

2. The problem of "specific determiners" or cue words was discussed earlier in the section on true-false items. Specific determiners should also be avoided in the alternative responses of multiple-choice questions. The use of ***"Only"*** in alternative "e" is an example of a specific determiner in a multiple-choice item.

Example

The soda lime (CO_2 absorber) part of the anesthetic should be checked?

*a. After each surgical procedure.
b. Before each surgical procedure.
c. Once a week
d. Once a day
e. ***Only*** after several operations

3. The alternative responses should be of approximately equal length. Lengthy, qualified responses are often the correct response.

4. Caution should be used when using "None of the above" or "All of the above" as alternatives. Too often instructors use these as alternatives to a question rather than giving a little thought to additional good alternatives. "None of the above" should never be used when the question is intended to differentiate between alternatives of various degrees of goodness. It should only be used when the different alternatives are unambiguously correct or incorrect. Also, "None of the above" like negative items has the effect of forcing students to select an answer which is not an answer.

   The use of "all of the above" should be avoided. If for example a five-choice item has "all of the above" as the fifth alternative and a student realized that two of the alternatives were correct then he would automatically know that "all of the above" was the correct response.

Example

IBR Virus causes the following:

a. Conjuntivitis
b. Infections postular vulvovaginitis
c. Abortion
d. Tracheitis
*e. All of the above

Summary of Rules for objective test construction:

General Rules

1. The reading difficulty of the test items should usually be kept low.
2. Do not lift statements verbatim from the textbook.
3. Start the test with a few easy questions.
4. Items based on opinion or authority should be accompanied by an indication of "whose" opinion or "what" authority.
5. Be careful that one item does not provide cues to the answer of other items.
6. Avoid the use of interlocking or interdependent items.
7. Alternative responses should occur as randomly as possible.
8. Avoid tricky and catch questions.
9. Items should be as clear and concise as possible.
10. Avoid items dealing with trivia.

True-False Items

1. Items should be unequivocally true or false.
2. Avoid specific determiners.
3. Avoid terms such as "frequently," "greatly," "to a considerable degree," and "in most cases."
4. Underline negative statements.
5. Keep items about the same length.

Short Answer and Completion Items

1. Beware of indefinite or open completion items where any number of words or phrases may be reasonable and factually correct.
2. Omit only key words.
3. Leave as few blanks in the statement as possible.
4. If at all possible put the blank or blanks at the end of the statement.
5. When the problem requires a numerical answer, designate the appropriate units to be expressed.

Matching Items

1. Items in a set should be homogeneous.
2. The number of answer choices should be greater than the number of problems presented.
3. A set of matching items should be kept relatively short.
4. Response options should be listed in some kind of logical order.
5. Directions should be clear and specify whether or not an answer choice may be used more than once.

Multiple-Choice Items

1. The item should contain a central theme or thought.
2. The item should be expressed in as clear and precise language as possible.
3. The question should be as short as possible and still give all the needed information.

4. Questions should be stated in positive form.

5. The stem of a multiple-choice item should clearly formulate a problem.

6. As much of the item as possible should be included in the stem.

7. Avoid using double negatives.

8. All of the alternatives should be plausible from the statement of the problem.

9. Avoid specific determiners.

10. The alternative responses should be of approximately equal length.

11. Caution should be used when using "none of the above" or "all of the above" as alternatives.

SUMMARY

This paper is meant to be an aid in the construction of an interpretation of valid and reliable classroom achievement test and is not intended to be the final word in classroom testing. Participants may validly differ with some of the precepts put forth in this paper. Good test construction is as much an art as a science and improves only with much practice, critical review and hard work. Each instructor must develop and use those testing techniques that work best in his particular situation.

PROFESSIONAL ASSESSMENT: AFFECTIVE DOMAIN

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It is an honor for me to participate in this symposium. This is not my first acquaintance with educational conferences for veterinary medicine, as I participated in the Purdue Workshop. Your profession is to be complimented. This gathering is excellent. You have a combination of workshop, symposium, and conference. I would like to commend the participants for their contribution in helping to fulfill the workshop portion of the program. I think you have been working very hard and your results are showing. You have learned a great deal.

First, I would like to specify four behavioral objectives. The focus of this symposium is on the development of mini-courses. The first responsibility that any program participant has is to specify outcomes that, as Dr. Mager says, will be so explicit that we will recognize them when we see them. My first behavioral objective is within two weeks, 50 percent of the symposium participants will have read the two handouts prepared by Dr. Franz Frederick and myself that have been distributed to you. Second is that within one year, 10 percent of the symposium participants will have specified at least three behavioral objectives in the Affective Domain and will have designed or selected at least one instrument for evaluating the effectiveness of the desired outcome. The third behavioral objective is within two years, a Symposium on Veterinary Medical Education will be held within the United States focusing on developments in the Affective Domain. My fourth behavioral objective states that within six months, 10 percent of the symposium participants will have selected or created an academic game to include as a part of their instructional process.

It is especially gratifying to me to be discussing the Affective Domain with you today because five years ago neither Dr. Block nor I would have been invited to discuss the Affective Domain in such a symposium. It was strictly taboo, even in teacher education or psychological conferences. People have a hang-up about designing attitudes and values to which all members of a given profession might work toward or subscribe. With this in mind then, I find the attitude and openness of this conference refreshing. I wish that we were engaged in such a symposium for teacher education at Purdue. What I am really concerned with in this portion of the symposium is fuzzy assessment. These are fuzzies that Dr. Mager referred to. Every speaker has alluded to this area of development, but no one has defined it.

I decided rather than focusing on the evaluation of outcomes in the Affective Domain, that perhaps I ought to develop a concept of what the Affective Domain is, what it means, what some of the implications are of objectives and instruction in it. Our speakers have talked about the Affective Domain. For example, Dr. Luther Terry said that we must research the relationship of pets and psychotherapy and we should check closely to determine really what the significance of the role of companion animals is in supporting good mental health. Dean Armistead did an excellent job in challenging us for the future. He made several statements referring to the Affective Domain citing the need to develop confidence in this area. He said veterinarians must change their attitude toward the importance of teaching in the Affective Domain and they must learn to value it more highly. The veterinarian must value his commitment to service, not just his commitment

to money, the benefits that might accrue from being a member of the profession. Further, he stated that the veterinarian must change the consumers' attitude toward the image of the veterinarian in the United States, to viewing the veterinarian as a real friend and counselor; someone who can be very supportive. He must no longer continue to be viewed as an impersonal scientific specialist. Dr. Armistead said that the veterinarian must develop a desire to preserve animal health and must no longer focus on treatment of diseases. Further, he said we must use students to assist in designing curriculum as well as research and in creating an improved instructional process. Dr. Robert Mager, said educators who are trying to create changes in instructional design are usually operating in a hostile environment. We must be concerned with this type of environment and make every effort to modify it.

I have had many conversations with a number of you and you are concerned about the Affective Domain. You are concerned with the attitude of your students. If you start toying around with mini-courses and specifying behavioral objectives, what will your students think about you? Will they appreciate what you are trying to do or will they sort of dismiss or laugh at you? How about your colleagues, will they support what you are doing? Will they add their support? How about your dean or department head? And how about the University? If we are operating in a hostile environment (and most of us are employed and provide services within a large corporation, college, or university), do the dean and the department head really have much choice in modifying the hostile environment or will he be nonsupportive? In other words, is all of this going to be worth the effort? You are also concerned about the professional attitude of future veterinarians. Can you really work within the Affective Domain and bring about changes in attitudes and values that are now held by future veterinarians, so that they subscribe to the kind of behavior that Dean Armistead outlined earlier?

What do we mean by the Affective Domain? I would like to refer you to the handbook entitled, **Taxonomy of Educational Objectives** by David Krathwohl, Benjamin Bloom and others. Within the concept developed by Krathwohl and Bloom of the Affective Domain, affect includes appreciations, attitudes, values, interests, and adjustments. It focuses on the process of internalization. That is, and I quote, "the inner growth that occurs as the individual becomes aware of and then adopts the attitudes, principles, codes, and sanctions that become a part of him in forming value judgements and guiding his conduct." I have provided you with a handout that explicates the levels of the Affective Domain. This is taken from the handbook of educational objectives in the Affective Domain. You will notice that these levels are numbered and begin with receiving and then move up through responding, valuing, organization, to the fifth level which is characterized by a value complex. When I refer to the process of inernalization, I mean that as you more fully internalize the behavior that you observe and subscribe to, then you move up to a higher level of the Affective Domain. In other words, as inner growth occurs you more completely adopt certain values, attitudes, appreciations. You can look at this when you have a bit more time and I think that it perhaps will help clarify part of the concept of the Affective Domain.

Now of course there are some obvious problems in dealing with measurement in the Affective Domain. Currently, at least, we cannot directly measure affect. Affect lies within the individual and may not be directly observed. We may attempt to measure some characteristics or properties of affect, however, this has pitfalls too. In reality we measure traces of behaviors which occur as a result of these characteristics. I would like for you to refer to the first overlay that I have made. Here you will notice at the bottom of the transparency traces of behaviors. Moving up, you will notice characteristics for properties of those behaviors and at the top you will notice affect. My example suggests that one trait of behavior might be someone who is always striking someone, hitting them, pushing them, shoving them, and we characterize this by the term hostility. This at the affect level means that there is some feeling toward a person, object, or event. In this case from my point of view, it is a negative feeling. Interestingly enough for you and me at the

professional level, there are people whom we would classify or characterize as hostile who strike others verbally, not physically, and they get away with it every day. They really are manifesting some feelings toward a person or persons or some object.

What we are concerned with is the measure of eight areas of affect and I have outlined these on the second overlay. We see emotional set, anxiety level, motivation level, attitudes, and attitude clusters, values, organization of values, problem analysis on the basis of both cognitive and affective concerns, and personal value systems. Now the question arises, what can you do as a veterinary medical educator? First of all, what can you do in regard to student response to your class or a new method of instruction. First, I would suggest that you read Dr. Robert Mager's publication, **Development of Attitude Toward Learning.** Within this he talks about, in general, two types of responses within the Affective Domain, approach and avoidance responses. Now for example, my young son responds very clearly and openly. I think you can detect his attitude. If I say, "Come on son, I want you to eat spinach and green beans," he usually pushes his chair back and says "yuk." But if I say come, finish your meal and then we will have a nice chocolate ice cream sundae with marshmallow and a marchino cherry, he leans forward and says, "Oh Boy, O. K., Yum, yum." In the first case, of course, we have an avoidance response and the second one, an approach. Now what you should do is to specify an objective that clearly defines the increased number of approach responses or decreases the number avoidance responses over a given period of time. Then tabulate these. In other words, make a list of responses within your classroom toward your teaching or a new approach and also avoidance responses. Then as you utilize a new approach, note these and tabulate them. Talk with them. Make some modifications and try to increase the number of approach responses and reduce the number of avoidance responses. This is one way of measuring outcome in the Affective Domain.

If you really want to improve in the number of approach responses, I think you can use Dr. Postlethwait's technique. He is relaxed and open. He demonstrated a sincere respect for each person's opinion and increased the number of approach responses toward him during his presentation to you earlier. Is there anyone here who really felt reluctant to approach him following his session during the break? I do not think any of you could answer that you really had any feeling of reluctance. You were willing to approach him. Thus, try a new method or a new technique, and then tabulate the number of approach and the number of avoidance responses.

A second thing that you are concerned with is how you can develop and improve the professional attitude of the future veterinarian, toward his clients. First, what must be defined is "What is a good professional attitude?" What does a veterinarian do in working with a client? Does he smile while giving a dog a shot? Does the dog smile? How does he treat the client? Some people have alleged that medical knowledge is not a measure of success, rather a pleasing personality. Is this really a necessary quality? How important is it? Do you do anything to prepare a veterinarian with a pleasing personality? In fact, should you? How should the future veterinarian behave toward his colleagues? Should he accept referral cases with ease and without making comment? Do you ever comment negatively when you are working in the clinic in front of aspiring veterinairans? When an old cow is referred to you from a veterinarian within the community, and this old gal is just loaded with burrs and manure, do you accept it professionally and on the basis of the report that the veterinarian has submitted? Do you encourage these young veterinarians to openly seek help from their colleagues if it is a tough case? Do you feel free to consult other faculty when you are in the clinic or do you view it as failure on your part to have to consult with another member of your faculty? And if you are consulted, how do you respond? Do you look at your colleagues in amazement? Do you look at him negatively? Do you find this an approach or an avoidance response?

Remember that when you are in the business of changing attitudes or shaping attitudes or values that one of the most affective means of changing

attitudes and values over a period of time is by becoming a model for a young person. If someone identifies with you and the profession through you, then he will begin to manifest your behavior. If a lady brings in a dog with a bad back and states she has been to three veterinarians and they have not been of any help, do you tell her you will cure her dog, that you have a new method? Do you suggest or tell her that you are a chiropractic adjustment specialist on spinal columns of dogs? Or do you suggest that you are really not surprised considering the inability of the other veterinarians in the area? Do you tell a client or an individual that you have Dr. M's secret serum for treating mastitis? Attitudes and values develop over a long period of time and you must serve as good models if you expect the candidates for the profession to assume the same behavior.

How do you assess attitudes? Specify behavioral objectives. Be precise and describe them and then design an attitude inventory. I would suggest the scale as described in the paper that Dr. Frederick and I developed under Dr. Frederick's name, "Measurement in the Affective Domain." Ask the faculty and students to complete this at the beginning and at the end of each year, or each semester. How about attitude toward the profession? Should the good veterinarian belong to a professional organization? Should he be active? Should he be inactive? Should he not be concerned? In teacher education we have an organization referred to as the Student National Education Association. I am sure this would never happen to you in regard to the A.V.M.A., but we have a terrible time trying to find a faculty member who will spend one night a month working with students setting up meetings so that they can become acquainted with one of the future organizations to which they will subscribe and pay hundreds of dollars, in a lifetime in professional dues. One of the problems that we have is that our professors schedule hourly or vigorous laboratory examinations at 8:00 in the morning following the night of a regularly scheduled monthly meeting of the S.N.E.A. I am sure that you probably do not have this problem, but if you do, then how in the world do you expect them to develop a more desirable attitude toward the profession than you? How do you assess this?

First of all, again, specify some behavioral objectives and design attitude inventory. Have the students complete it and then complete it again after a period of time, a year, and compare, and you will note a trend occurring. Of course, there are other things that happen. You will find that more professors will begin to give priority to meetings, one objective that you may specify, for example, is that no examination will be held the day following a meeting of the student chapter of the A.V.M.A. I think you can think of other objectives that will make a significant difference immediately. I would also suggest that you develop a pool of the behavioral objectives among your colleagues and with colleagues at other universities. There is no need really for each of you to reinvent the wheel every time you gain insight into a problem of your concern or a method of determining outcomes that have been achieved in the Affective Domain.

Another question that you have raised is, how can I change the attitude of my colleagues toward the need for improving the instructional process? This is not a simple matter. You are talking about achieving something that is at the highest level of the Affective Domain. What you are really attempting is to modify your colleague's philosophy of education. He has experienced success. He has a damn good memory and nothing succeeds like success. If there is one thing that I know about you, I know that you have a tremendous memory. Each and every one of you. The rules of the game of the past have required it and they still do. I think I understand your program well enough to assume that if there is one thing you are most proficient at, it is memorizing concepts, ideas, facts, knowledge. This is at the lowest level of that Cognitive Domain, if you check out handbook number one by Krathwohl and Bloom.

What you are asking your colleagues to do (who are less motivated by the establishment of mini-courses and specifying objectives in the Affective Domain) is to change the rules of the

game, to be concerned about behavior, to be more concerned about the application of facts and knowledge and to be more concerned about the attitudes of the professional, or just as concerned as we are about cognitive development. So you are asking them to really reorganize their whole value complex that they had internalized.

How do we assess this? I think that deans and department heads have a responsibility to devise an attitude scale or use one that has been developed. Any one of the three described in the one paper may be of assistance. They should work to gather evidence to show growth and specify some behavioral objectives which in the very process will result in a great manifestation of support of the dynamic and creative members of your staff.

In the short time I have spent with you this afternoon what I have tried to do is, to fulfill these behavioral objectives. I have tried to summarize some of the statements and comments that demand attention in the Affective Domain. I have given you one brief and concise definition of Affective Domain to stimulate your thinking. I have tried to outline some of the problems that you will encounter and have encountered in specifying as well as assessing behavioral objectives in this domain. I pointed out the need for assessment of development in the Affective Domain and some suggestions for achieving the assessment. I have provided you with three handouts. They should assist you in developing a clear concept of the Affective Domain and eliminating some of the fuzz on the fuzzy. One of the handouts provides you with instructions for completing an academic game. Be sure that you read that before the 8:15 a.m. session tomorrow. We will play it then. Hopefully, as you design mini-courses in veterinary medicine, you will become concerned with development in the Affective Domain, the process of internalization: **"The inner growth that occurs as the individual becomes aware of and then adopts the attitudes, principles, codes, and sanctions that become a part of him in forming value judgements, and in guiding his conduct."**

TOWARD THE SETTING OF MASTERY PERFORMANCE STANDARDS IN VETERINARY MEDICAL EDUCATION

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Although the concept is old, one of the most powerful forces shaping present educational theory and practice is Bloom's (1968) notion of mastery learning. Mastery learning proposes that all or almost all students can master most of what we teach and challenges us to find classroom strategies whereby this proposition can be realized. The basic problem in the design of these strategies, though, is how to define mastery.

Yesterday Dr. Mager dealt with the first aspect of this problem, namely, how to define what students are expected to master in terms of a set of instructional objectives. And earlier today Drs. Hedges, Smith and Gardner dealt with the second aspect, namely, how to translate these objectives into a set of evaluation experiences (e.g., test items). In this session, therefore, I wish to grapple with the last, but most overlooked, aspect of the problem, namely, how to set the mastery standards against which a student's performance can be judged.

My presentation will consist of three major parts. First, one reason why we need the best possible mastery standards will be suggested and then some characteristics of an ideal standard will be proposed. Next, some practical techniques for setting standards which begin to approach this ideal will be developed. Finally, a few of the many issues you are likely to encounter as you wrestle with the standard-setting problem will be sketched.

The Need for Good Standards

Let me begin, then, by turning to the question, "Why do we need the best possible mastery standards?" The answer is simple. Without such standards it is impossible to elicit optimal learning from each student. Regardless of the quality of one's evaluation instruments, poor standards will cause some, perhaps many students' learning to be misevaluated. These misevaluations make it impossible to design either group-based or individualized instruction of optimal quality for each learner (Block, 1972; Glaser and Nitko, 1970). Further, in those cases where the misevaluations underestimate a student's learning capacity, they help to destroy his desire to learn and even undermine his actual learning capacity (Block, 1972).

The Idea Standard

Having suggested that good standards are a necessary condition for eliciting optimal student learning, let me now propose some characteristics of an ideal mastery performance standard. First, the standard must derive from the same values that guided your choice of instructional objectives. Too often we forget that the setting of performance standards, like the choice of objectives and testing instruments, depends on values (Stake, 1970). Hence, by encouraging students to achieve specific objectives to particular standards, we are in

essence socializing them to the values inherent in the standards and to those inherent in our objectives. Unless these two sets of values are congruent, then students will be socialized to inconsistent values. Unfortunately, in resolving these inconsistencies, many students will accept the values implicit in our standards rather than those explicit in our objectives. For example, teachers often select objectives stressing the value of cooperation in learning yet use standards emphasizing the value of competition. Consequently, their students are socialized to both values. Many of these students often resolve this conflict by accepting the notion that learning is basically competitive.

The second characteristic of the ideal standard is that it must be non-arbitrary in the sense that its superiority vis-á-vis other possible standards can be logically and empirically defended (Bormuth, 1971). In the past we have tended to choose our mastery standards arbitrarily as if one were just about as good as another. Many of us, for example, have used a score of 90 percent correct as a standard of A work when a score of 85 or 95 percent might have served just as well. Similarly, many of us have used a convenient break in a score distribution to distinguish A from B work, but we have used different breaking points from year to year.

This practice can no longer be justified. Recent research reveals that some standards are distinctly better indices of the adequacy of a student's learning than others and that the attainment of different standards can have very different effects on different dimensions of a student's learning. For example, two years ago I taught eighth graders a three-unit, matrix arithmetic sequence (Block, 1972). One group of students learned under no requirement that they attain any particular per unit performance level. Four other groups learned under a per unit performance level requirement, but each group learned to a different level, i.e., learned either 65, 75, 85, or 95 percent of the unit's material. The findings indicated that only attainment of the 85 and 95 percent levels did have significant positive effects on student learning. But attainment of the 85 percent level yielded maximal learning when learning was characterized by affective learning criteria and less-than-maximal learning when learning was characterized by cognitive learning criteria. The reverse was true for attainment of the 95 percent level. The implication of findings such as these is clear. We simply cannot afford to continue requiring students to reach performance standards whose attainment has ***little effect*** on various dimensions of their subsequent learning when standards can be set whose attainment will have ***maximal*** effects.

The third characteristic of the ideal standard is that it must be absolute. By "absolute" I mean three things. First, the standard must separate students into two groups only--"true" masters and "true" non-masters (Harris, 1972). This implies that the standard selected must be set in such a way that the number of students misclassified is zero os as near zero as possible. Second, the standard must be calibrated solely in terms of a student's learning rather than in terms of his learning relative to his peers. Finally, the standard must serve as the only hardstick for determining the adequacy-inadequacy of each student's learning.

The fourth characteristic of the ideal standard is that it must be used only in conjunction with performance data provided by so-called "criterion-referenced" (Glaser and Nitko, 1971) testing instruments. This characteristic ensures that whether the student is or is not judged to have mastered a given segment of instruction depends on ***what*** he has learned rather than ***how well*** he has learned relative to his peers (Block, 1971). It also ensures that attainment of the standard has a clear meaning in terms of a well-defined group of objectives (Glaser and Nitko, 1971).

The fifth and final characteristic of the ideal standard is that it must be feasible; that is, the standard should be attainable, given reasonable investments of human and non-human resources and teacher and student time.

Some Possible Techniques

We are now in a position to consider some techniques for setting standards which begin to

approach this ideal. In recent years a number of promising empirical techniques have evolved. But because these techniques require some background in statistical and psychometric theory, I wish to skip them here and to focus instead on some less technical approaches.[1]

Summative Standard Setting Techniques

The first group of techniques is designed to set what might be termed "summative" mastery performance standards. These are standards used to judge the adequacy-inadequacy of each student's learning on the basis of his performance on a summative evaluation instrument (Bloom, Hastings, and Madaus, 1971) administered at the end of a course, semester, or term.

Expert Judgment. One technique utilizes experts' judgment and is patterned after an approach used by the Office of Strategic Services (1948) in World War II to determine individuals' fitness for high-risk espionage missions. First, a panel of experts, the standard setting team, would be chosen. Then, each expert would be asked to arrive at a reasonable standard and to indicate the reasons for his choice. Finally, the experts would be asked to arrive, as a team, at a consensus standard via the process of deliberation (Walker, 1970).

Though similar to discussion, deliberation has a practical (Schwab, 1969) goal––in our case, the selection of an appropriate standard. The deliberative process would take place in three phases. First, each expert would propose his standard and, more importantly, the reasons for his selection. Second, the experts would argue about the various alternative standards and especially the reasons which underlie these standards. The purpose of this phase would be to extract the basic criteria the experts used in arriving at their standards and to submit each criterion to public scrutiny. Finally, the team would be asked to arrive at a set of defensible criteria from which the standard should derive and to select that standard which best meets these criteria.

The quality of the standards yielded by this technique obviously depends on the composition of the standard setting team. The more the team is representative of those diverse groups who have major stakes in the quality of students produced by our veterinary colleges, the better the standards are likely to be. For example, a good team might consist not only of practicing veterinarians, health officials and faculty members, but also of students who have already covered the material over which the standard is to be set. Further, these individuals might be drawn from local communities or rural areas and/or from the state or nation as a whole depending upon the locale or locales in which you expect your graduates to practice.

Expert Test Results. A second technique resembles the first, but here the expert's performance on "criterion-referenced" tests is partially substituted for his judgment. Once again, a panel of experts would be chosen. Then each expert would be given psychometrically sound criterion-referenced tests over the areas for which standards are to be set. The expert would be requested to respond to each test item in two ways. He would indicate whether he believes the item tests material which the student must master, and then he would attempt to answer the item. If we let X equal the total number of items on a particular test that the panel believes cover material the student must master and let Y equal the number of these X items the panel answered correctly, then a perfect score over either these X or Y items could serve as a mastery standard.

Besides the obvious problem of selecting a representative panel of experts, there is one major drawback to this approach––the amount of testing involved. One way around this problem is to use item-sampling procedures (see Bloom, Hastings and Madaus, 1972). Suppose, for example, that you have a 100-item test in canine anatomy and wish to set a mastery standard on the basis of test results from ten experts. Rather than giving each expert the whole test, you could break the test into distinct subtests. Then you could randomly assign one subtest to each expert. The responses of ten experts to these 10-item subtests should give you roughly the same data for setting a

mastery standard as if you had given each expert the full test.

Case Studies of Master Veterinarians. A third technique, suggested by the work of Lee Schulman and his colleagues at the College of Medicine, Michigan State University, utilizes case studies of a sample of acknowledged "master" veterinarians. In this approach, each "master" veterinarian would be closely studied to discover the types of problems he typically encounters; the variety of skills and knowledge which he might bring to bear on each type of problem; the particular set of skills and knowledge he actually uses and why he chooses this set over others; and finally, the manner and sequence in which he employs the skills and knowledge selected. On the basis of this information for the entire sample, one would then extract those skills and that knowledge which seem to characterize the "master" veterinarian. Next, these skills and this knowledge would be categorized according to particular areas of study or courses offered by your respective institutions. The criterion-referenced tests for each area or course would be content-analyzed to identify items testing the relevant skills and knowledge. A perfect score over these items would constitute mastery.

Use of National Boards and State Practicals. A fourth technique makes use of the national veterinary medicine qualifying examination together with the various state practical examinations. In this technique, these tests are considered to provide a general working definition of the competencies as "master" veterinarian should possess.

To use the technique, first the competencies tested by each exam would be outlined and correlated with the competencies tested by the other exams. Those competencies which seem to cut across most of the tests would be taken to represent the competencies a "master" veterinarian should possess. From here on, the same procedure discussed in the third technique would be used. First, these competencies would be categorized according to the areas of study and courses offered by your institution. The criterion-referenced tests for each area and course would be content-analyzed to identify items testing competencies the "master" veterinarian is believed to possess. Finally, a perfect score over these items would be set as the mastery standard in each area or course.

Use of Pre-existing Standards. A fifth, and by far the poorest technique makes use of previously established performance standards. To use this technique, all that one must do for each area of study or course is to establish the score on the relevant criterion-referenced testing instrument above which students' learning under non-mastery conditions received A's. This score would be set as one's mastery standard.

Formative Standard Setting Techniques

To this point, I have focused on summative mastery standard setting techniques. But as those of you who have read Bloom's (1968) "Learning for mastery" paper know, a successful mastery learning strategy requires not only summative evaluation to determine how students ***have changed*** with respect to a set of objectives, but also formative evaluation to provide on-going feedback about how students ***are changing*** (Airasian, 1971). Besides summative mastery standards, therefore, you will also need what might be termed formative mastery performance standards to indicate the adequacy-inadequacy of each student's learning at various stages ***during*** a course, semester, or term.

While some of the summative standard setting techniques can be adapted for use in the setting of formative mastery standards, there is a far better approach (Block, 1972). All mastery learning stretegies presume that the attainment of particular performance standards at each stage in the student's instruction will ensure mastery in his learning by the instruction's completion. Consequently, an excellent way to set formative mastery standards would be to select that standard at each stage in the instruction whose attainment best maximized each student's likelihood of reaching a given summative mastery standard by the instruction's completion. Such standards can be selected easily using elementary decision theory notions.

Some Issues

Let me close now by broaching just a few of the many issues you are likely to encounter as you attempt to apply these techniques or develop your own.

One issue is whether you should judge mastery on the basis of a single performance standard or on the basis of multiple standards. All present standard-setting techniques arrive at a single standard, usually a particular total test score, under the assumption that the competencies being tested are sampled from a relatively homogeneous population. Frequently, however, this assumption is unjustified because the competencies tested are sampled from a collection of distinct, homogeneous sub-populations. Rather than treating this collection as if it were homogeneous and setting a single mastery standard, perhaps we should set a standard for each sub-population and judge the student's overall mastery on the basis of his performance vis-á-vis these multiple standards. Suppose, for example, we wished to evaluate a student's mastery over a collection consisting of three independent sub-populations of competencies. We would set a standard for each sub-population and compare the student's performance on items testing competencies sampled from these sub-populations against the appropriate standard. If he performed at or above standard in each sub-population he would be judged to have mastered the collection of competencies of interest.

A second issue is whether you should set the same standards for all individuals, i.e., *universalistic* performance standards, or set different standards for different individuals, i.e., *particularistic* performance standards. Throughout American education there is a growing retreat from forms of schooling and evaluation that treat the student as a member of a social system. One consequence of this trend is that teachers are facing increased pressure to assess the adequacy of their students' learning in purely particularistic terms. Before any of you unwittingly bow to this pressure, reflect on the fact that universalistic standards are essential to the survival of our society. Neither particularistic nor universalistic standards alone are sufficient if we are not to compromise the individual for the sake of the society or the society for the sake of the individual.

The final, and undoubtedly the most thought-provoking and highly charged issue is whether you should set mastery performance standards in the affective domain. In recent years, there has been a distinct resurgence of the idea that schools must simultaneously foster the student's cognitive and affective development (see, for example, Brown, 1971). But while it is clear that affective development has once again become a legitimate instructional objective, it is not clear whether we should evaluate student mastery in the affective domain.

I would assert that we should. I am sure that many of you are startled by this statement and find the notion repugnant. At first so did I. But upon closer examination of the issue, try as I might, I found no good theoretical reason other than hypocrisy for not evaluating mastery in the affective domain when we do evaluate it in the cognitive. Consider, for example, the notion of invasion of privacy and let me pose the following question: In the last analysis, is it not just as great an invasion of the student's privacy to test his achievement or aptitudes as it is to assess his attitudes and values? The answer, I think, must be yes unless one is willing to make the absurd argument that a student's achievement or aptitudes are not his own.

A Closing Remark

Obviously, a brief presentation of this type cannot make you experts on the standard setting problem. But as Bloom (1972) points out in a recent and powerful paper, modern education is wallowing in a pool of innocence brought about by our lack of awareness of the problems that beset us. I fervently hope that these remarks have contributed to your loss of innocence regarding one of these problems.

FOOTNOTES

[1] The reader interested in exploring these techniques is strongly encouraged to consult the papers by Block (1972), Harris (1972) and Millman (1972) listed in the bibliography.

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THE AFFECTIVE EVALUATION GAME

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The Affective Evaluation Game is designed to afford an instructional designer the opportunity to devise an affective instructional situation with a basic evaluation design.

The behavioral objective for the game is:

> "Given an affective learning objective, a specific learning environment, a 'mini-evaluation strategy,' and a media selection matrix, the player must create a learning design which specifies a learning sequence, learner activity, the appropriate media, and appropriate evaluation procedures."

The Affective Evaluation Game has three basic phases of play:

I. The Design Phase

II. The Evaluation Phase

III. The Discussion Phase (optional)

I. The Design Phase. The materials used in the design phase are:

1. Objective cards––these cards describe an objective which is affective in nature (e.g., it may deal with attitudes, values, emotions, etc.).

2. Learning environment cards––each of these cards specify a particular pattern in which learning could occur (e.g., small group, large group, individualized instruction, etc.).

3. Evaluating mini-strategy cards––each of these cards contains a suggestion for an evaluation strategy for affective behaviors. Actually these are only mini-strategies. They must be combined with testing concerns such as pre-testing, post-testing, and/or continuous evaluation in order to produce a "complete" evaluation strategy.

4. Media matrix––a table for selection of media which identifies types of media across the top and specifies "properties" of media along the side. To ***use*** the matrix one would find the properties necessary for his learning design and then see which media ought to be used. The steps for use are:

   a. locate the desired property in the property column and glance across that row
   b. where the property is associated with medium, you will find a symbol or symbols in the cell representing the intersection of the property row and the medium column
   c. examine the legend at the bottom of the matrix for the meaning of the symbols
   d. decide which of the media associated with that property you wish to use.

5. The design sheet––the design sheet is designed to help you specify more precisely your design. It has ***five*** sections:

a. Objective section--you are to circle the properties which your objective possesses. You may rewrite the objective if you wish but you must maintain the spirit of the objective.
b. Learning sequence--you are to specify a series of learning steps which would lead a student to the objective. You must label each step with a number (generally the numbers would be in sequential order).
c. Learner activity--you are to specify appropriate learner activities and indicate by number the step in the learning sequence at which the activity would occur.
d. Media and materials--re-examine your learning sequence and the learner activity, then scan the properties to identify the appropriate media. Specify media to be used including the appropriate learning step number. Also you will justify the use of media at that particular step.
e. Evaluation--you will specify an evaluation procedure on the basis of your mini-strategy card and the use of pre-testing, post-testing, and/or continuous evaluation during learning. You will then justify your strategy in a short paragraph and specify how effective the strategy would be.

The play of the game proceeds as follows:

1. Each stack of cards is shuffled and one card dealt to each player face down. Each player should then have one of each of the three kinds of cards--e.g., A1, B3, C2.

2. The players each receive
   a. a media matrix and
   b. a design sheet.

3. The players are allowed fifteen minutes to *read* their cards (which define the boundaries of their individual learning design problem) *and* to *complete* their design sheets. At the end of this time the game moves into the evaluation phase. Be sure to write the numbers of your cards at the top of the design sheet.

II. The Evaluation Phase. The materials used in the evaluation phase are:

1. The player's completed design form *and* his set of cards

2. The Media Matrix *and*

3. The Affective Learning Design Scoring Sheet.

The evaluation phase begins when a player completes his design. The player passes his design, cards and matrix to the player on his left who then becomes an evaluator of the design. Each player becomes an evaluator during this phase and uses the scoring sheet to evaluate someone else's design.

The time allotted for evaluation is 10 minutes. At the end of this time the sets of cards, design sheet and matrix are passed to the next person on the left. This person now evaluates the materials. In a three player game each design is evaluated twice. In a four player game each design would be evaluated three times. The completed evaluation sheets and the materials are returned to the designer for re-consideration. At this point the discussion phase may becin.

III. The Discussion Phase (Optional). The purpose of this phase is to query their evaluators at length about the evaluations. As a result scoring could be adjusted or the designer could be allowed additional time to re-design his learning design.

The game is obviously open-ended and was so designed to allow it to be used in numerous ways.

IV. Example. Assume that a player received the following three cards:

Objective Card:

Objective --
Given a desired goal by the student and two or more sets of conflicting information regarding the goal, the student will voluntarily employ some version of the scientific method to test the information.
A3

Learning Environment Card:

Learning Environment ––
You may choose to use either
a. individualized instruction
b. large group instruction
c. independent study
d. small group instruction based upon
(1) ability grouping or
(2) interest grouping

or some combination of the above in order to accomplish your goal.

B1

Evaluation Mini-Strategy Card:

Mini-Strategy ––
You will be concerned not only with identifying an observable behavior which is related to the students' internal affective behavior (e.g., attitudes, values, emotions, etc.) but also with ***tallying*** its occurrence.
You might –
1. specify that the behavior appear in response to the stimulus two consecutive times
2. specify that the behavior occur a minimum number of times

C2

Using the cards, your task would be to specify a sequence of learning leading to the goal, learner activities, media and materials that would be utilized, and an evaluation design to determine the effectiveness of learning. You may use the material from either of the two Mini-Resources, "Some Functions of Testing" and/or "Measurement in the Affective Domain."

SOME FUNCTIONS OF TESTING

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The major function of testing is to determine the state of something (say a student) with respect to some goal, objective, or value. Within this major function there are at least three subfunctions:

1. To assess the ability of a student
2. To assess the performance level of a student, and/or
3. To assess the effectiveness of the learning environment (e.g., the learning materials, the instruction, etc.)

Table I shows the relationship of the techniques of pre-test, post-test and continuous evaluation to these three subfunctions. The table also indicates the nature of questions which may be answered by using these techniques.

Now let us examine Figure 1. Figure 1 represents an attempt to show schematically the purposes of the evaluation procedures shown in Table I.

From an examination of Table I and Figure 1, one may observe that the following questions may be answered by the mini-designs of evaluation shown in Table I.

1. What are the abilities of a student?
   See A1.1, A1.2, A1.3, in Table I.
2. What does the student know before instruction and/or learning?
   See B1.1, B1.2, B1.3 in Table I.
3. What does the student know after instruction and/or learning?
   See B2.1, B2.2 in Table I.
4. How *much* does a student know as a result of instruction and/or learning?
   See B3.1 in Table I.
5. How *much* does a student know at each stage in his learning?
   See B4.1 in Table I.
6. Does the student learn as a result of the instruction and/or learning materials?
   See C1.1 in Table I.
7. How can one determine which parts of the learning sequence need revision or replacement?
   See C2.1 in Table I.

There are also questions which may be asked about the validity of the learning and/or instruction, the reliability of learning and/or instruction, and the validity and reliability of the tests themselves. These questions are however reserved for another Mini-Resource booklet.

TABLE 1. Mini-Designs Involving Pre-Tests, Post-Tests and Continuous Evaluation

Assess Ability	Assess Performance Level	Assess Effectiveness of Learning Environment (e.g., learning materials, instructor, etc.) based upon performance level assessment
Pre-Test only:	**Pre-Test only:**	**Pre-Test and Post-Test:**
A1.1 to determine whether to allow student to enter learning sequence	B1.1 to determine the students' performance with respect to some norm (e.g., standardized test)	C1.1 to determine how much a student learns (pre-test subtracted from post-test score). This answers only the question of overall effectiveness of the learning procedures. It does ***not*** permit one to identify the effectiveness of portions of the learning procedures.
A1.2 to determine which materials or sequence student should use based on level of his ability (a "branching" type of decision)	B1.2 to determine whether student already possesses the terminal behavior(s)	
A1.3 may be used to provide information as a co-variate for a co-variance analysis on order to extract the effect of ability. A learning gain as measured by subtracting pre-test scores from post-test scores may be the result of (1) the instructional environment, (2) the original ability of a learner or (3) some combination of (1) and (2). By using pre-test information on ability as a co-variate one may determine whether the gain is due to the learning environment or ability or both.	B1.3 to diagnose students' level of performance in order to determine areas of weakness and strength. The purpose is to then prescribe supplementary learning experiences.	
	Post-Test only:	**Continuous Evaluation:** (involving pre-test and post-test)
	B2.1 to determine the level of student performance after completion of learning sequence. (***NOTE:*** This does not tell whether the student learned from the materials ***or*** whether the student now performs more poorly ***or*** how much he learned.)	C2.1 to provide information about student performance as he proceeds through the learning sequence as well as beginning and ending performance. Allows one to identify portions of the learning sequence and/or environment which need revision or improvement.
	B2.2 to diagnose students' level of performance in order to determine areas of weakness and strength. The purpose is then to prescribe supplementary learning experiences (tends toward remedial work).	

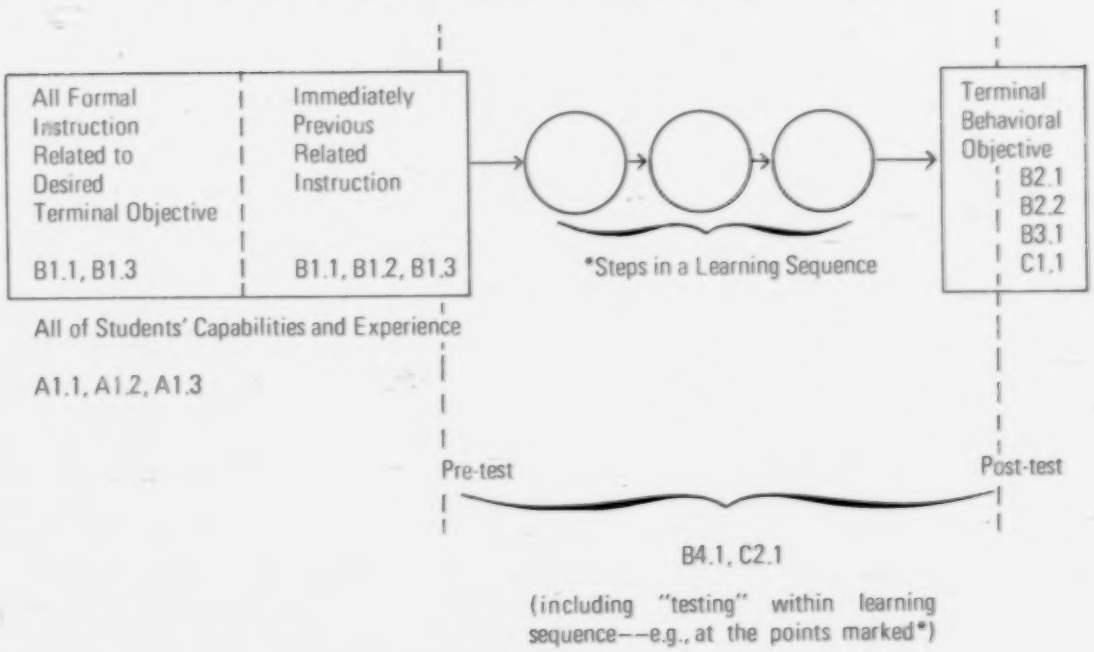
Pre-Test and Post-Test:

B3.1 to determine how much a student learned (a gain score arrangement e.g., subtract the pre-test score from the post-test score). This information answers the questions raised in **Post-Test No. B2.1.**

Continuous Evaluation:
(including pre-test and post-test)

B4.1 to provide information about student performance as he moves through the learning sequence. Allows one to profile a student's performance by various aspects of the learning sequence.

FIGURE 1. Schematic showing Relationship of Testing and Learning



MEASUREMENT IN THE AFFECTIVE DOMAIN

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According to Fred Kerlinger (6, p. 413), "measurement is the assignment of numerals to objects or events according to rules." In the cognitive area of learning the specification of these rules (e.g., hypotheses, theories, and/or relationships between what the learner "knows" and what he "does" or "can do") are relatively straightforward. The measurement process is the same with regard to affective concerns but the "rules" are considerably more difficult to specify.

A Major Problem

The major problem in measurement in the affective domain lies in the fact that currently, at least, we cannot directly measure "affect." "Affect" lies within the individual and may not be directly observed. We may attempt to measure some characteristics (properties) of affect only to find these to be ephemeral too. In reality, we measure traces (or behaviors) which occur as a result of these characteristics. This chain of relationships is shown in schematic form in Figure 1.

To "measure" affect, we must (1) measure some traces of behavior, (2) infer some characteristic(s) which influence the occurrence of the behaviors and (3) infer a relationship of the characteristic(s) to some major area of affect. This would not be a particularly difficult problem if the inferential relationships were as straightforward as shown in Figure 1. In many cases these inferential relationships may be as shown in Figure 2.

Let us consider two cases based on Figure 1. First, suppose we choose behavior B_1 as evidence of affective concern No. 2 and proceed to measure B_1. Now if, B_1 occurs, are we justified in concluding that the student has affective concern No. 2? No, because B_1 also is a reflection of cognitive concern No. 1. In this case B_1 may be due to either one or some interaction of both. Second, it may very well be the case that in order to demonstrate the "existence" of affective concern No. 2 that we will need to have behaviors B_1 *and* B_2 *and* B_3 occur. In this case the occurrence of only B_2 may not be adequate *because* it may occur as a result of some irrelevant process or concern.

The major problem of measurement in the affective domain as "Are the responses (behaviors) a function of the affect rather than some other variable or process?"

Major Affective Concerns

For the purposes of this paper we shall assume the following areas of affect:

1. emotional set
2. anxiety level
3. motivation level
4. attitudes and attitude clusters

FIGURE 1. Inferential Relationships of Trace Behavior to Characteristics of Affect

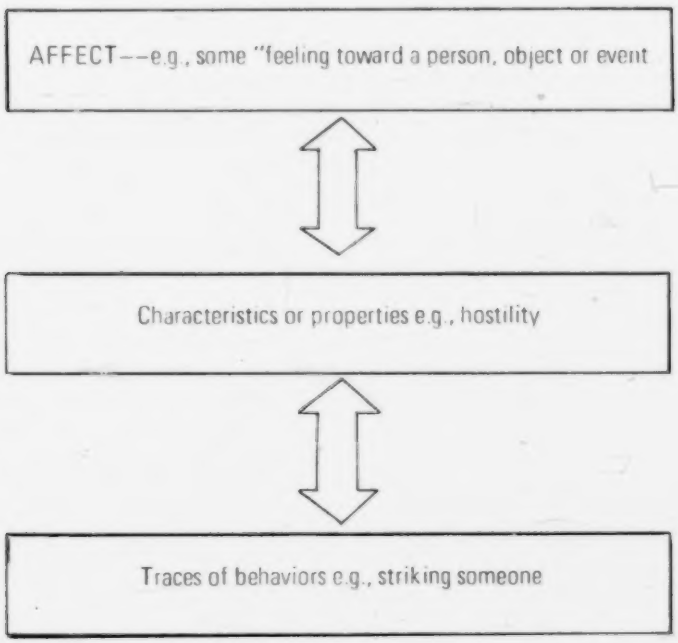
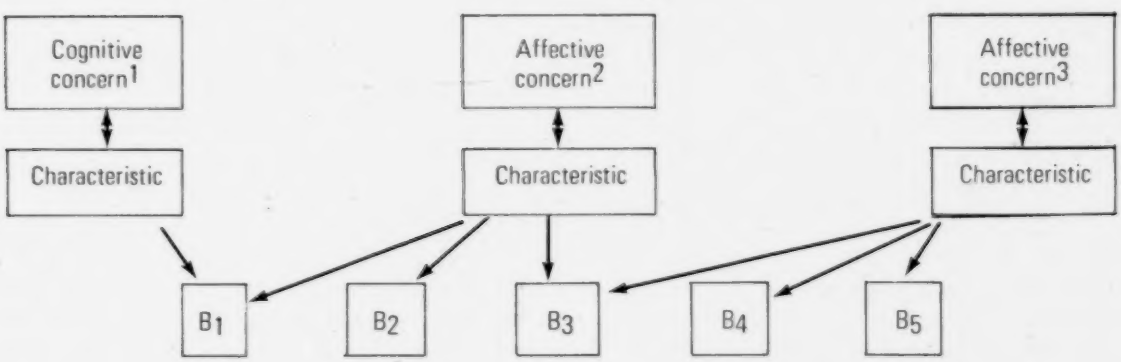

AFFECT--e.g., some "feeling toward a person, object or event
Characteristics or properties e.g., hostility
Traces of behaviors e.g., striking someone

FIGURE 2. Example of the Complications of Inferential Relationships Between Behavior Traces and Characteristics



5 values

6 organization of values

7 problem analysis on the basis of both cognitive and affective concerns

8 personal value systems.

The areas listed above stem from various sources including research and the **Taxonomy of Educational Objectives: Handbook II: Affective Domain.**

Every learner has a set of ***emotions*** and these emotions have to some extent been "attached" to various stimuli and situations. Emotional set refers to the extent to which emotions are aroused by new stimuli or situations.

It is difficult to change strong emotional sets so our purpose would be to help the learner to attach "positive" emotions to those stimuli and situations important to a particular field.

Anxiety level has an important effect on all learning. Generally speaking, learning efficiency improved as anxiety level increases. There is however a plateau and regression or inhibition effect. The importance of anxiety level can be readily observed--e.g., if a person is at a very high anxiety level then his learning performance may be imparied.

Motivation has been presumed to be more critical than specific ability and indeed this explains overachievement. Underachievement has likewise been explained as the result of ability without motivation. Motivation then appears to be a critical ingredient to any learning situation. Research has also demonstrated a relationship between motivation and anxiety.

An ***attitude*** is basically the ***predisposition*** to act, react, think, feel or perceive in a certain way. Attitudes appear to be related to emotional set, anxiety level and motivation level. Attitudes represent "approaches" or "avoidances" to generalized sets of stimuli or situations. It may be critical to learning to know what attitude a student has toward stimuli or situations similar to those critical to a particular field of training. Negative attitudes (avoidance) may cause an inhibiting transfer to the new stimuli or situations.

A ***value*** is a conceptualization stemming from an attitude. It usually results in a generalized statement implying a moral or ethical judgement--e.g., "honesty is the best policy." A value is often culturally weighted. The steps toward the business of valuing involve (1) learning to accept a value say for the sake of argument, (2) establishing preference for one or more values in a field of values, and (3) committing oneself to action on the basis of a value(s). These steps are hierarchically ordered. Training in a profession would be incomplete without learning to value based on ***all three*** of these steps.

The ***organization of values*** deals with the creation of sets of consistent values. To do this one would need to (1) be able to conceptualize (i.e., frame it as a generalized statement) a value in one's own terms and (2) to organize sets of values which are not mutually contradictory. These steps may also be hierarchically ordered. In order for one to be able to alter his own life style or professional direction he must be able to both conceptualize and organize values.

Problem analysis is a big concern in many professions but in the past it has centered on cognitive analysis while tending to omit affect. Decisions may be made "rationally" and yet not be effective because of lack of concern for affective features of the problem. The problem analysis level represents the point at which one begins to place different weights on different outcomes because of organized sets of values.

To be more than a "hit or miss" professional, one must formulate his own consistent ***personal value system*** (e.g.,--a philosophy of life). Generally speaking, a person who is unable to do this will have problems in his profession as well as his personal life.

The above listed areas of affective concern are arranged in hierarchical order--i.e., each level of affective performance requires some level of competency at each of the preceding levels of affect.

Response and Measurement

All of the levels of affect discussed previously relate to internal states of being on the part of an individual. As was mentioned previously they are not susceptible to direct measurement, consequently one must resort to indirect measurement. Usually the measurement involves a judging process either by the individual himself, by another "judge," or both. In either case the learner is asked to respond in some fashion--usually a direct response or a projective response. In the direct response, he is asked to judge himself and this tends to produce an artificial and not too accurate response. In the projective response, he is asked to judge someone else (perhaps a hypothetical person or situation) and as a result tends to use his own emotions, attitudes and values for that person's emotions, attitudes and values.

It has been found that when a stimulus is relatively unstructured and ambiguous, a learner will project his own emotions, anxieties, motivations, attitudes and values. The projective evaluation techniques utilize one of the following kinds of responses.

1. Association--the learner says the first thing which comes into his mind after being presented with a particular stimulus. The responses would then be analyzed to see what kinds of emotions, attitudes or values are associated with the stimuli. Another approach is to have the learner give as many associations as possible for a given stimulus. Usually these are analyzed for total number and the number of different categories generated within the associations for each stimulus.

2. Construction--the learner is asked to produce something. Given a simple stimulus the learner constructs a picture or a story based on the stimulus. The product is then scored on the basis of originality, divergency of thinking or perhaps McCellends' Nach (need to achieve).

   Completion--the learner is asked to finish a sentence, a paragraph, or a story line. The result is usually classified by a judge and the results counted or profiled.

4. Choice or ordering--the learner is usually asked to indicate a ranking for some statement based on a rating scale. In another approach he may be asked to choose from a group of statements those with which he agrees. The choices or rankings are usually summed or averaged and then treated mathematically.

5. Expression--similar to construction, but the emphasis is not on the product but the way in which the product is created. The number of times a learner manipulates or perhaps approaches something becomes the measurement variable.

Unfortunately the projective techniques generally (see 1, 2, 3, and 5 above) require a judge to make a careful but subjective analysis of each response. This is not only inordinately time consuming but it also tends to be unreliable. Usually the more reliable the judgment, the more time consuming it is. Now it is possible using a relatively structured stimulus as in No. 4 above and using certain scales or scaling techniques to more reliably measure responses. Let us examine Table I to see which projective response methods are most useful for the previously specified areas of affect.

Scales

Examination of Table I reveals that the choice and/or ordering response procedure will tend to yield the most objective measurement data. This is achieved at some loss of the "projective" property because the items are more highly structured.

Scales are measuring devices designed to place an individual on a continuum of agreement with regard to motivation, an attitude or a value. Three major types of scales are:

1. the cumulative scale (Guttman-type)

2. the equal-appearing interval scale (Thurstone-type)

Table I. Projective Response Techniques Useful for "Measuring" Various Kinds of Affect.

	Emotional set	Anxiety level	Motivation level	Attitude	Acceptance of a value	Preference for a value	Committment to a value	Conceptualizing values	Organizing values	Problem analysis based on affect	Personal value system
Association	X	X		+							
Construction				X			+	X	X	X	X
Completion		X		X	+	+	X	X	+	+	
Choice or ordering	+ *	+ *	X *	X *	X *	X *	X *		+ *		+ *
Expression	X	+	+	+			+				

X means best suited for measuring these types of affect.

+ means it is possible to use this response procedure for evaluation with some ingenuity.

* means these items are most amenable to "objective" evaluation (use of mathematical or statistical analysis procedures).

3. the summed rating scale (Likert-type).

Scales then furnish a relatively effective device for using the choice or ordering response procedure to "measure" motivation, attitudes, or values.

Both the equal-appearing interval scale and the cumulative scale allow the learner to respond only with one degree of agreement or "a forced choice." They do not allow intensity of expression of motivation, attitude or value. The summed rating scale does on the other hand allow this. The advantage? It simply permits retaining of the maximum projective quality in a relatively objective measurement procedure.

Scale Construction

The only scale construction considered here will be the construction of a summed rating scale (Likert-type).

One of Likert's primary concerns was the development of a measurement device in which the items measured the same common factor (e.g., motivation, attitude, or value). To devise your own Likert-type scale use the following steps:

1. Determine which attitude value or aspect of motivation you wish to "measure."

2. Create or collect a large number of items which are ***either*** obviously favorable ***or*** obviously unfavorable to the factor you intend to "measure." The collection should contain only one kind of item, not both favorable and unfavorable.

NOTE. Tips on writing good items: (a) be clear and unambiguous; (b) be brief; (c) make sure it contains only one complete thought; (d) use simple sentence format, and; (e) use a five point agreement continuum with the item--e.g.,

strongly agree	agree	uncertain	disagree	strongly disagree

3. Identify a ***large*** sample of learners who are representative of the population to be measured by the final scale. (The larger the sample the more reliable the resulting scale.)

4. Give each item to each member of your sample. Total the scores for each subject using a value of 5 for strongly agree down to a 1 for strongly disagree if the attitude is favorable.

(NOTE. If the attitude is unfavorable then use a value of 5 for strongly disagree down to a 1 for a strongly agree [see Step 2].)

5. Determine which subjects fall in the upper 25 percent of scoring (these subjects tended to respond with agree and strongly agree).

6. Determine which subjects fall in the lower 25 percent of scoring (these subjects tended to respond with disagree and strongly disagree).

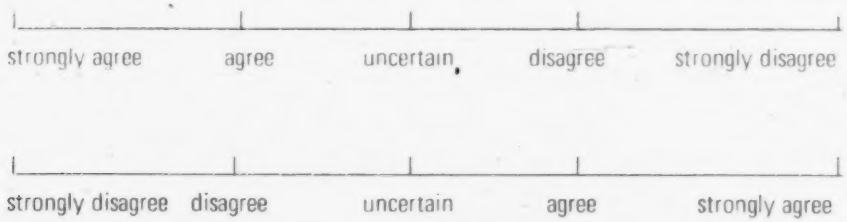
7. Calculate the mean score for each item for the upper 25 percent.

8. Calculate the mean score for each item for the lower 25 percent.

9 Determine the difference score for each item (Step 7 – Step 8 = difference score). Keep the items with the highest difference scores. ***These items become the items for use on the final scale.***

10 When you administer the final scale, use the same scoring procedure as in Step 4. The score of a learner is the sum of his response weights. This score will rank the learner with respect to other learners in regard to the ***particular*** factor measured.

NOTE. Be sure to randomly alternate the direction of the response scale, e.g. –



This should be done in order to avoid response set on the part of the learner.)

Now for a ***Caveat Emptor*** ---

Be sure that each item written is based upon a characteristic or property of the same area of affect. This means that in Step 2 above, you ought to identify all pertinent characteristics of the factor you wish to measure. Then prepare a set of items based on each characteristic.

Summary

By now some of the problems in measurement in the affective domain will be apparent to you. It is a difficult area in which to attempt measurement but it is ***not*** impossible.

This paper has attempted to delineate to some extent areas of affect, to specify useful response techniques to show problems of analysis of responses, and to show you how to create a scale for measurement in the affective area. This is by no means a complete discussion of measurement of affect but rather a doorway into this area of concern.

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ACADEMIC CREDIT: EXPOSURE OR ATTAINMENT?

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There are two purposes for this presentation this morning. First, to question the potency of the present academic accounting system in American universities. In working with the veterinary faculty at Georgia and others in professional education, I have come to feel that all of us are overly impressed with or committed to the present accounting system. This system is particularly crippling in that it is primarily based on time or exposure rather than stipulated competencies.

Second, I suggest to you that tests are like budgets. If one wants to know what the actual priorities are of a school, club, or governmental institution, he looks at how that organization spends its money. The actual educational philosophy of a college is revealed in what and how it recognizes achievement. Thus the two major points I want to impress upon you this morning are: (1) The present academic accounting system in American academic communities is not good; (2) Testing, more humanely considered and more broadly developed and applied, can be an answer to some of today's problems.

Serving Time

Our educational practices seem to result in having students serve time rather than attain a set of definable goals. Under a Ford grant Hannah Kreplin did an extensive review of how American education got in the business of giving credit in terms of hours spent. This review reveals that from 1870 to 1898 colleges began to measure the teaching of subject matter in hour units; and in the period of 1890 to 1910, the credit system was consolidated, high school and college courses were listed in units of credit and degrees were given on the basis of a certain number of credits earned.

One of the primary stimuli that brought this about was related to the development of faculty pension systems. That is, the time unit approach to crediting educational achievement was confirmed in eligibility standards for institutions to participate in the pension program for teachers.

Kreplin points out that the Carnegie Foundation for the Advancement of Teaching in 1906 initiated a pension plan for college teaching. Institutional eligibility to participate in this plan included these conditions: the college should have at least six full-time professors engaged in university and college level instruction; it should have a program of study of four full years in the liberal arts and sciences; and it should require all students that are admitted to have four years of high school preparation or its academic equivalent. In measuring four full years of high school preparation, it was expected that the accepted high school unit of credit would be used (one credit as one academic year course meeting for five periods each week). This we now know as the Carnegie unit. According to Kreplin, the Carnegie Foundation stated explicitly that the fundamental criterion was the amount of time spent on a subject, not the results obtained. The General Education Board of the Rockefeller Corporation, through its pension plan, adopted the Carnegie Foundation Formula for eligibility of institutions. By 1910 educational credits in high school and college were securely based on time considerations.

Bill Owens recently recommended a study to me, a section of which I want to read to you.

> "Colleges and schools like prisons have dealt with their inmates largely on the basis of required sentence of time to be served. A

college education normally requires four years after high school. During these years a prescribed number of credits will be earned and each of them requires so many hours of study spent in laboratories, libraries and high schools. There are, of course, certain things required to pass the course; but over and above those, the only measure of education commonly used is time. However brilliant the student's performance, he usually must still serve his hours for each credit and accumulate his credit over the four required years."

The study involving the above quote was primarily concerned with an analysis of college students in Pennsylvania along with a representative sample of high school students. A six hour test that included such things as vocabulary, literature, general science, fine arts, history, and social studies was used to measure the academic proficiencies of the students. Some of the findings were as follows: On the English section of the test, one third of the freshmen from ten liberal arts colleges scored higher than one half of the seniors. In general science, literature, fine arts, history and social studies, one senior in five was below the freshman average. In mathematics, the average freshman was better than the average sophomore, the average sophomore better than the average junior, the average junior better than the average senior; only one third of the seniors were as good as the average freshman. Fairly expert knowledge of science was found in 300 of the seniors, 250 juniors, 300 sophomores, and 80 freshmen. Nevertheless, the 80 freshmen who knew science as well as the best 300 seniors and better than 600 other seniors still had to serve their three years of time before they might rate as ripe for graduation.

In the case of one of the colleges, which was representative of the colleges, in above study, the question was raised--what if that college had graduated its 200 best students based on the test, rather than the 200 students that had stayed at the college for four years. That is, what would the graduating class have looked like? An analysis revealed that the graduating class would have been 25 percent seniors, 28 percent juniors, 23 percent sophomores, and 24 percent freshmen. The average age of the graduate would have been reduced from 22 to 20 years, and the average performance on the test would have been increased by about 150 points. This study was done by Learned and Wood from 1928 to 1932. It was reported on by Goodwin Watson in a Carnegie Foundation monograph in 1938. It is interesting to note that Goodwin Watson has been particularly involved in the University Without Walls approach where the central concern is to credit students' attainment without regard to time spent.

How does one explain a system of collegiate educational system supposedly designed to produce competency in students that grants degrees in terms of time spent. Kenneth Bolding in a recent article on the schooling industry in America, states there are four basic services of that industry. One is to produce knowledge in students; a second is to produce a certain set of skills; and the fourth to certify competency. However, what is the third? Custodial care! He makes the point that if a local school board wants to pass a referendum to increase school taxes, it would be judicious if the referendum were held near Labor Day after mothers have had their children home for three months.

How did we get to a four year curriculum? Kreplin's Review of Credit by Examination cites a study by Jones and Ortmann which sets forth several reasons why American education settled on a four year curriculum. First, little trust was put in teachers' final examinations, and because external examinations were not established in the United States, the time spent on the college campus became the convenient measure for the accrediting agencies which started functioning in 1914. Such agencies were seeking a standard by which to evaluate colleges; hence they promoted the theory that all students should take a prescribed amount of work in a prescribed fashion. Furthermore, American educators came to emphasize four years of social and intellectual campus living quite apart from credits earned. For example, James Lee Peacock said that the first thing he would do if he started a new college would be to build a smoking room; and then if he had any

money left over, he would build a library. If there were any money left over after that, he would hire a faculty. It was in this tradition that Princeton had social clubs. Many of us went to small liberal arts colleges, some of which had a religious flavor. These colleges inevitably incorporated close inter-personal relationships among faculty and students and emphasized that there was something to be gained beyond the explicit competencies in the formal curriculum. But how well can that be done in a university of 30,000 commuters in an urban setting that hasn't a single dormitory? The growing sector of American education is the community college, and the newer ones do not have dormitories. We have moved a long way, and perhaps will go even further from the more cloistered approach to higher education. In a recent issue of **Saturday Review,** Husen reviewed a survey of multinational mathematics achievement of 13-year-old students conducted by the International Association for the Evaluation of Educational Achievement. Such factors as length of the school week, time devoted to homework, time devoted to mathematics homework, and time devoted to mathematics instruction accounted for only about three percent of the total difference of achievement in mathematics. Altogether this survey included 26 factors, four of which I mentioned above. The 26 factors only accounted for 25 percent of the variance of the students in their achievement on mathematics; the four that I cited accounted for 10 percent of the 26 percent. It was concluded that for both 13-year-olds and pre-university students, time devoted to instruction seemed to be insignificant in all of the 12 countries included in the study.

Data similar to this was cited to a past dean of the College of Education at the University of Chicago; that is, that time spent in school and the quality of schooling seemed to make no difference in the achievement of students. His response was "I've never thought that the quality of teaching made any difference." The Coleman report that is being systematically reviewed at Harvard and a number of other reports appear to indicate that the amount of money spent on students or the nature of the instructional process makes little difference in students' achievement. As a result, those interested in international education are suggesting that the Western European and the American schooling models should not be adopted by developing countries. Rather, such countries should try to integrate work and learning and not create separate institutions for the training of their people.

There is in our culture an interest in de-institutionalized education. I'm not sure how far I would go in this regard, but I am very committed to the idea that we should separate credit from time spent in school and relate the giving of credit and degrees directly to the consenually observed achievement. Some of you may hestiate in that you believe that education is not just achievement. It may not be, but I would challenge all of us to thoroughly and comprehensively analyze the content of the tests upon which we presently give credit and see how well they reflect the lofty curriculum goals that appear to be more rhetoric than reality. The fact is that if we were profoundly concerned with recognizing academic attainment, we would not be giving credit for passing courses when the person who teaches it, also tests students, and then judges their performance by his own standards.

While tests have been chastised throughout the Sixties, they can contribute much. In the previously cited study of Pennsylvania colleges, the student that scored the highest of all the students attended the college that had the lowest average score. The student was asked, "How do you explain your phenomenal score?" He replied, "It's due to my careful study, that I did entirely on my own, of every Sunday edition of the **New York Times.**" This would not have been revealed without tests.

Advocating the separation of evaluation from instruction is not a new idea. The University of London from 1836 to 1900 has no internal students. Its prime purpose was to examine students of other institutions and award them their degrees. Oxford has always had a tradition of having its students stand for in-depth comprehensive exams for their degree. The University of Georgia also had the tradition and Colter has described its practice and rationale as follows:

"Examinations were based on the assumption that the student had been amassing a sum of knowledge which tended to unify and coalesce into a related whole, not filling little compartments from textbooks unrelated and to be immediately forgotten when the crises had been successfully passed. Therefore the examinations at the close of the first two terms were mere harbingers of the searching inventory to be taken at commencement time on all the studies of the proceeding year. The senior examination was guarded with particular care because the Bachelor of Arts degree was given only to those who were successful. This examination was a general one upon all the studies of both the last two and many of the proceeding year. Or as the rules stated, it should be rigid and extend to the whole course of collegiate literature and only those found well skilled in the liberal arts and sciences should be given degrees. Following their vacation, the students devoted their whole time to reviewing their past four years' work against the day of their examination."

The rationale was as follows according to Colter:

"The test of the pudding is the taste thereof is a saw honored with age and truth. Examination time was tasting time and since tasting should be done more than by the cook alone, in the original charter, a Board of Visitors was established. It first took on flesh and blood in 1811 when three trustees were named Visitors. Later the number was increased to fifteen and membership was not limited to the trustees. The most distinguished men in the state were generally named and urged to attend the senior examinations as well as the others. In 1825, President Waddell noted that the governor attended the junior class examination. In 1834, the University announced that the senior examinations would begin on June 23 and continue from day to day until the Board of Visitors was satisfied, and added the college and faculty would be gratified by the attendance of parents or guardians, and literary gentlemen who may have it in their power to attend."

The word accountability was not used by Colter, but the concept is incorporated by what he described. However, public people were invited to a public examination of the students before the state university granted its degree.

Dartmouth as early as 1831 had external examiners. Eliot, the great reform president at Harvard, advocated external examiners in his 1869 inaugural speech at Harvard. Paradoxically, he also promoted the elective system in American higher education, and that may have done as much as anything to entrench the single course examination.

Hutchins established a board of examiners at Chicago in 1831. Bloom said that the purpose for the board was as follows:

"In planning a new curriculum in general education the faculty wishes to separate the examining and judging function from the pedogogical function. They wished to have the instructor serve primarily to help students learn and they believed that an ideal student-teacher relationship was impossible when the teacher also had the responsibility for judging and grading the student."

In medical education, the strongest program, in my opinion, of proficiency measurement is being directed by Christine McGuire at the University of Illinois Medical School at Chicago. As I understand it, professors teaching courses in the professional curriculum do not construct their own tests. Rather tests are developed by committees composed of professors and measurement specialists. Emphasis is upon problem solving items rather than recall of information alone. Given all of the theoretical merit of and a history of prestigious support for separating the evaluation of students' proficiencies from the facilitation of teaching of those proficiencies, why has this not been done more extensively in American higher

education? A number of contributing factors emerge as one considers this question. I will suggest the ones that have occurred to me but in no order of importance.

One such contributing factor is the dedication of American colleges and universities to the elective system. Students tend to have such disparate programs that a common comprehensive examination would be difficult. Therefore, Eliot's interest in outside examiners has been thwarted by his other initiative of introducing the elective system. Another factor is that mass higher education has depleted our ability to do in-depth critical examining of individual performance.

But I believe that we already have strategies and techniques in measurement design along with the advances in computer applications to testing that will make it feasible to examine the proficiencies of individual students in terms of the educational goals of their particular degree programs. Furthermore, veterinary medical educators do not have the masses of students to deal with that faculties do in many other areas of a university. Finally, I would suggest a change of roles that faculties may need to adopt. That it is essentially to make students more responsible for their own learning given clear objectives for their study; such a change would make it possible for faculty to spend more time inspecting students' achievement either for placement, diagnosing learning problems, and eventually certifying proficiencies.

Another factor has to do with a socio-economic function of education in our society. We sometimes naively assume that education is only to produce competency when actually it is providing a way to occupy youngsters in advanced technological cultures that do not need them for its work force. This was Boulding's point, as I cited earlier--"custodial care is one of the four economic functions of education in America."

Fourth, explicit standards and judgments based on them tend to frighten us. Students sometimes would rather try to slip through the cook-tasting mode rather than having to confront a more open, objective system. Perhaps they feel insecure and wish to have the possibility of "conning" the teacher for more than they might get from the more open, objective system. In one of our neighboring universities a science course is being taught using audio-tutorial approach. The enrollments in that course have declined somewhat. Some observors close to the situation believe that the students may be avoiding the more explicit standards of the audio-tutorial approach. Furthermore, some suggest that American students today want an emotional "experience" rather than intellectual mastery. If this is so, it is a consequence, I believe, of over institutionalizing education in that we keep youngsters in school passively receiving information too long. They have little opportunity to apply what they learn, and perhaps are satiated with cognitive input; thus they eschew the intellectual or cognitive and turn to the emotional or affective.

Some feel that more standards might lead to a new social elitism but this does not necessarily follow. The point that is being made about mastery learning by Bloom and others is that we want to set minimal standards that everyone who gets a particular certificate or credit should meet and not unduly limit that effort by time constraints. Under this approach, the main difference among learners would be how rapidly they move through a given system, not how much they achieve in comparison to one another. To me, this is a better approach than having everyone spend the same amount of time and then having their individual differences manifested in different amounts learned rather than time spent.

Professors in general may be reluctant to make judgments about the performances of others. Ebel, who writes very insightfully about evaluation problems in higher education, has written the following:

> "Instructors . . . sometimes dislike to assume the role of examiners. Most of them prefer to be helpful rather than critical. There is something inconsiderate about probing the minds of other human beings and passing judgments on their shortcomings. There is even something presumptious in assuming the right to set the standards by which others will be judged."

Given the fact that students do not need as much the delivery of information, as we seem to think they do, given the frequency with which we lecture. However, they do appear to need a great deal of guidance toward and certification of their proficiency; therefore we are going to have to spend more time doing what we are not so inclined to do--evaluating their (students) achievements.

I am going to be audacious enough to propose a new role for faculty members. I suggest that the role of a faculty is to become a collective referent of academic achievement. For example, a small college is trying to build a competency matrix for its curriculum. Though this is a desirable move, I predict that it will be hard for the students to identify with such schema. If such matrix of competencies could be translated into what the faculty actually represents then students could more readily understand and identify with the goals of their education. First of all, any faculty should be the personification of knowing some area of study well. There is a difference between just being an intelligent layman and knowing something in particular in depth. Furthermore, once a profession, such as veterinary medicine, has come to perceive of itself in terms of such a distinction, it will only invite persons into its fraternity who are different from the general population in the same ways. Every student who graduates with a D.V.M. is to become your colleague in the profession; and his knowledge and competence should be referenced against the faculty's proficiency. Therefore, first a faculty must determine what it knows that makes it different from generally intelligent laymen and then learn how to inspect for these critical differences in its candidates for graduation. This is a very difficult task and you have a long way to go, but no further than other professional groups, in learning how to reliably inspect for the critical distinctions of being a veterinary medical scientist.

Many of you may know or have heard of Walter Perry, the former Dean of the Medical School of Edinburgh, now the Vice Chancellor of the new Open University in England. One of the achievements of the Open University that he is proudest is that, programs of study have been and are being developed by professors working on teams with educational technologists. Cooperative teams produce systematically designed programs of study to reach certain goals.

Perhaps, one caution should be observed about planning instructional programs for other people even when you know what the instructional goals are. At one university it is reported that when a new building is finished sidewalks are not put down right away. Rather they wait to see where the students make paths than sidewalks are put on those paths. The lesson for curriculum planners is that if they are clear about where they want students to go and reasonably adept at determining when they get there, educators could stand back awhile and see what kind of learning routes the students make. That is, given the resources of the university, which resources do the students use in order to get where they need to go? I hope that some of this will be done in the University of Georgia's experimental curriculum in veterinary medicine scheduled to begin this September.

Virginia Zachert at the Medical School at Augusta has another approach to curriculum design. She has a professor delineate what he wants the student to know or master. In essence she just says, "Tell me, what are the things that make the difference between a person who knows and does not know this area?" Then she had students that have mastered these same things work out a program of study that will help beginning students learn these things most quickly. It is hard for a professor to perceive learning tasks as they are perceived by someone who is at the point of ignorance. On the other hand, a person totally ignorant of the matter to be learned could not design a program of study. So Dr. Zachert has a good compromise. She has a person that had just learned, design the instructional program because he is the best compromise between knowing how the untutored perceive the task and what it is that must be learned.

In my opinion, the major task before academics is to begin to do a better job of evaluating student achievement. M. W. Richardson said 36 years ago that no one has solved completely the question of making examinations reflect course objectives. As

far as I know we are **not** doing much better today. Progress, in this regard, can only be made by our becoming very clear about criteria of achievement which demands either very clear instructional objectives or reasonable consensus in judging creative achievements that cannot be set forth in explicit terms. In regard to the latter, there are areas of achievement, for veterinary educators such as in judging clinical performance, where you will have to rely upon consensual judgments rather than explicit objectives. When you cannot be as verbally explicit as you would like to be in stating objectives you should concentrate on the degree of reliability of the jury or panel judgments of performance.

A great deal is being said about criterion measurement. If five years ago one had wanted to know how to make better tests, somebody like myself would probably have handed you a pamphlet on construction of examinations. One of the things that pamphlet would have told you is that after you have given the test you should analyze each item in terms of its discrimination capability. Perhaps you would have separated the upper 25 percent of the students on the test from the lower 25 percent. Then you would have identified those items that discrimnated between the top 25 percent and the lower 25 percent. Those items that perfectly discriminated would have had a discrimination index of .50. These are the items that you would have kept for future use; the others would have been thrown out. Given this approach, assume that you had taught 20 students a set of surgical techniques. Further assume that they knew nothing when they came in but all became quite proficient by the time they were through. It is obvious that your instructional program was effective in that they all became proficient. Furthermore, in the different test situations they all performed satisfactorily. Given this, how are you going to do an item analysis in terms of a discrimination indices? According to the traditional view, you should discard your items because everyone got them. Most standardized tests are built on this approach, and that obviously reduces systematically the ability of tests to be sensitive to treatment differences--that is, to instructional effects.

I will close by discussing some of what will be involved if you really get serious about criterion measurements. Several years ago Gullikenson published an article on how to establish content validity beyond having knowledgeable people say that the items are appropriate; I will very briefly review his article. The typical way to go about determining if one has a good test is to have experts look at the items on the test and determine if it is a good item. That may be about the best we can do at one level, but Gullikenson advocates that we go beyond this in several empirical ways. One way is a factor analysis approach. He gives the example of a spelling test--typically administered by having the teacher read so many words with the students writing them down. A student may be able to spell the words under these conditions; but, if he is writing a theme, he may misspell the same words. Or, if you ask him to recognize correctly spelled words from incorrectly spelled ones, he may not be able to do so. That is, the criterion may be multi-factored. What needs to be done is to determine if such is the case, and if there is only the appearance of multi-factors, and if the factors are clustered.

The second way is related to judging performance by juries or panels. It may be that people on panels are responding from different prospectives. For example, you may ask a jury to judge the way a veterinarian sets up his practice, in terms of management. One professor might look at it in terms of efficiency. Another may view it only in terms of a profit margin. Another may be looking at its public relations effects. Therefore, it is important to factor analyze the judgments of the experts on the panel.

A third approach is to examine the criteria in terms of the variables that predict them. For example, college grades are best predicted by high school grades and slightly less well by tests of verbal ability. College grades do not predict anything very well--even grades in graduate school and professional school. Grades in professional school, according to some studies I have seen in the area of medicine, do not predict performance in the clinic much above the level of

chance. Grades received in graduate school also seem to have a very low relationship to the number of articles one may publish in his career. This ought to tell us something--perhaps that grade getting behavior only predicts grade getting behavior and that not too well. In this case perhaps we ought to judge grades in the light of what they predict or fail to predict.

On the other hand, judging criteria in terms of what predicts them may be seen in another example. During World War II, Gullikenson found that a test of mechanical knowledge and comprehension was a poor predictor of final ratings in marine engineering school. A simple arithmetic test was the best predictor. This was strange in that the training involved only one week of training in arithmetic and four weeks of training in mechanics and shopwork. In calculating final grades, the arithmetic score on the final test was only one-seventh of the final grade while the shop work grade was weighted four-seventh's. So why would the arithmetic test account for a great deal more of the variance of the final grades than the mechanical comprehension tests which was weighted much more heavily. An investigation revealed that grades of shopwork had no useful referents for their judgments and just tended to rate everyone's work about the same. These raters realized that they could not be very reliable in their judgments so they got together and decided to let all ratings fall in a very constricted range. The solution lay in developing better instrumentation for evaluation. Such was developed; and when it was employed, the test of mechanical knowledge and comprehension became the best predictor of final ratings. If we are in the situation where verbal ability is the best predictor of grades in veterinary school; and grades in veterinary school do not predict performance in the field; what we may be doing is training **students** not necessarily veterinarians. Finally, a combined factor analysis of the predictor variables as well as the criterion variables should produce a comprehensive matrix of what constitutes the criteria.

Gullikenson's last point is that we usually judge the educational treatment in terms of the students' performance on the criterion test. It may be that we will have to judge the tests by how sensitive they are to educational treatments.

In review, serving time is a poor measure of educational achievement. I propose the separation of certification and evaluation from instruction, and I suggest that this is not a new thing under the educational sun either in advocacy or practice. Faculty, in general, are reluctant to make judgments. People who have written very sympathetically about evaluation from a teacher's point of view say that instructors sometimes dislike to assume the role of examiner. Most of them prefer to be helpful rather than critical.

Nevertheless, I have proposed a different role for faculty members. First, what we have been doing as far as dispensing information appears not to have been very effective. Dubin and Tavegia found that there was no difference in students' performance who had been instructed differently on teacher-made examinations. An instructor at the University of Tennessee, a very exciting lecturer, decided that he would see if coming to class made any difference in the performance of students. So he randomly assorted students in introductory psychology into: (1) a group that did not attend class. (He told what they would be tested on and dismissed them until they came back to the mid-term and then the final.) (2) Another group came to class one day a week and, (3) a third group came three days a week. When he got through with the course, he could not distinguish the groups in terms of their performance on the final examination. I believe that we are not so crucially needed as frequent lecturers that we cannot afford to do less lecturing so that we can spend more time assessing student achievement.

What will happen if credit is not based on amount of exposure. I think it will cause us to clearly delineate our functions in education and thereby achieve a clearer focus of what we are doing. It will also make possible the individualization of instruction in that time will not be a major factor; and it will give you, the faculty, the ability to exercise some control over the quality of the graduate that you certify.

CAREER PLANNING

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Effective career planning for the prospective student and efficient manpower planning for the profession are, conceptually, two sides of the same coin. If we use the student's best capabilities, we best serve the profession that he enters. Essentially both of these concerns turn about the same question; i.e., what does this prospective student need in order to be successful, first, in school and second, in his chosen profession. Clearly, an answer to this question is going to be a partial answer. It's going to suggest a few major dimensions, but that is all. Let's try to answer it.

At least in part then, the prospective student needs some of the following things. First, he needs realistic knowledge regarding the nature of both training for and practicing in the profession. Now, I would underscore realistic here. I would say this for several reasons. First, of course, he has to be able to feel himself in the role of the practitioner and it's important that the information be accurate if he's going to do this well. The literature of both vocational guidance and industrial psychology clearly indicate that realistic expectations reduce turnover. In industry this sort of thing has been approached along the lines that you tell a job applicant not only what is good about the job that he's applying for, but what is bad about it and what it is that he probably won't like. And if he takes it under these circumstances, he's likely to stick. If he takes a description of the job that's been carefully washed with gold, he may find, undoubtedly will find, that it's not up to his expectations and he may very well drop it. I think that realistic is a very important word here.

Second, Dr. Harris' proposal that we advance and graduate students on the basis of competencies makes great good sense, if we know or can learn the relevant skills and competencies. So here also we need realistic knowledge of the profession. I want to suggest that we might get a little feedback from the field, in terms of a questionnaire or opinionnaire. Clearly, we also need a very careful job analysis. No opinionnaire is going to be adequate for this purpose. Third, a rapidly changing field, which I'm convinced veterinary medicine is, needs benchmarks in terms of which to measure its evolution or in terms of which to porject its future.

Let me read four things out of a little piece that's done by Richard Holdeman at Purdue which have to do with getting some feedback from the profession. I think all of the points that he mentions will be familiar, but I think all of them are well made. Among them, Holdeman's results show that veterinarians believe that their profession is taking a turn toward specialization, and they feel that educational revisions must be made to accommodate this trend. That is, they feel that some allowances should be made to permit students to specialize or choose electives while in veterinary medical school. Second, course areas which were specified most often as in need of more emphasis include business management, liberal arts, nutrition, preventive medicine, and diagnosis. Many veterinarians stressed the need for more practical experience during veterinary training, and some recommended that internships be required. It was felt that future recruitment of DVM's should take into account changes in the nature and directions of growth within the profession which imply that the necessity of a rural background, for example, is decreasing. Attempts should, thus, be made to give urban students greater exposure to the nature of opportunities in veterinary medicine.

All the first slide is intending to do is suggest that graduates of veterinary schools fall into a variety of specializations under r[illegible], training, teaching, administration, la[illegible]nal practice, small animal practice, and probably other pursuits that I am unaware of. This is the world of occupational experience. It is the world that we need to know something about. Some important questions are: In channeling students into careers, what is the image of veterinary medicine by high school students and their counselors? For example, in the Holdeman survey, there were two rather surprising findings. High school students generally grossly underestimated the income of veterinarians and overestimated the educational requirements. Second, how accurate are the expectations and how relevant are the motivations of pre-veterinary students? And third, and undoubtedly most important, what are the impressions of those in the field regarding appropriate training patterns?

A second requirement beyond realistic knowledge of the profession is, of course, that the students possess some relevant aptitude and academic skills. Slide two is a probability table, an empirical probability table, based on experience with the old veterinary aptitude test prior to the revision. It shows in the highest quarter on the test the probability of being in the upper half as far as grade point average is concerned is 0.76. With persons in the second quarter 0.58, with people in the third quarter, 0.40, and persons in the lower quarter, 0.22. Then there is correspondence generally and broadly between scoring on the Veterinary Aptitude Test and grades in veterinary school. I don't think anybody doubts this. Although we were slow to revise the test, it is better now and the relationships are higher than they used to be.

On slide number three, the distributions in red are the distributions of students admitted to medical schools in this case, because we don't have this on veterinarians. The dotted lines are School C and the solid lines are School A. This is meant to point out that there are enormous institutional differences. You'll notice that the mean score of persons admitted to School A is about 660. And the mean of those rejected is about 557. And the mean score at School C of those accepted is 483 and the mean of those rejected is 473. Now, in terms of career planning and in terms of the profession, I'm sure the implications of this are entirely clear to you. First, any procedure that permits this sort of thing to happen is grossly unfair to the students who applied at School A and were rejected. They have all the potential to become better veterinarians and better students than most of those that were admitted to School C. From the student's point of view from the career planning side, one should first inquire whether the student has the aptitude to graduate from a particular institution. It is clear that sutdents who may fail to be admitted to School A could easily get into School C. Indeed, they may be the best that School C has. Inequality of standards then represents unfairness to the student and a waste of talent to the profession. It is accompanied by parallel inequalities of graduates. The reason Harvard graduates students with superior atptitudes and achievement test scores is that it admits students with superior aptitudes and achievement test scores. There isn't any differential effect in institutions.

A third requirement then when you look at career planning requirements and what it takes for a student to get into the profession is an appropriate pattern of interests. There may be some question about what interests are you for. I know it's old hat with all of you that you need an appropriate pattern to go through. The chief correlate of interest, however, is not productivity. That's not true in industry and it is not true on the academic scene. The chief correlate of interest is tenure. People who are interested in the work they're doing stay in it, those who are too disinterested quit. But it is not necessarily true that those who are most interested produce most. They may like the job so well that they go out and drink coffee with the boys all morning and tell each other what a great job it is. Slide four shows data for dental schools. These data relate to dental scores and continuing dental school. They go back to the time when there was considerable attrition in order to make the point. I'm sure you can glance at this table and catch its importance as well as I can point it out. But among people with dental interest ratings of A, notice that about

100 percent of the first year students are there and about 90 percent of the fifth year students are there. Now if you drop clear down to C ratings, look what happens. Now most of the first year students are still present. But look at the fifth year students. There are 25–30 percent of them at the most. The rest are gone. So the people who have low interest ratings tended to drop out and the same thing will happen in the profession. So interest isn't just something that is nice to have or that leads to high productivity. It is something that keeps people at the particular job that they have the interest in.

A final point and I am through. The third thing that we all recognize a student needs is a qualifying set of personal characteristics. This is very difficult to decide. We've played with psychological questionnaires and gotten nowhere. Recently at the university here, we have engaged in a project which involves the administration of a biographical questionnaire to entering freshmen and, cutting the facts to the bare bones, we've cast people under subgroupings that have about the same kind of background. And we find that these people who have the same kinds of prior experiences tend to exhibit the same kind of subsequent experiences and that, indeed, these turn out to be fairly good functional definitions of kinds of people.

I'd like to try to convey two things to you. The first is that there is a great deal of evidence that both in the school and in the occupation that those people in these differing subgroupings have affinity for different kinds of performance. For example, we took this approach to Humble Oil Company and got their management people to complete the questionnaire. What we found was about 83 percent of their salesmen on the validation staff all came from three subgroups and the differences between the three subgroups were stylistic differences. The people in the one subgroup were mainly ex-Southwest Conference athletes who scored more because everybody liked them, they knew them and they had visibility, and so on. The second were a typical group of people of a little above average academic aptitude, a history of electional leadership, positions in some outstanding verbal pursuit. And the third group were people who rang more doorbells than anybody else. They had moved to sell.

All I want to suggest to you along this line is that I haven't tried it, but I have every confidence that there are differences between veterinarians who go into research and administration and small animal practice and if there are any, large animal practice and so on. We can find them if we want to. I've heard, I don't know how many veterinarians, deans of the veterinary schools, people I've respected highly say, "Well all this stuff you measure is good, but if you'll just get a measure of motivation, then we'd be somewhere." I believe that we are approaching a functional measure of motivation in this biographical data approach. We've had no luck trying to measure motivation per se as an entity, but what you measure when you measure autobiographical data correlates is evidence that it has existed in the past in the individual. And the interest that it will exist in the future then is a very good interest.

I've tried to suggest three or four things to you hastily: (1) That it is important that the student have a realistic knowledge of the profession. (2) It is important that he have an appropriate set of aptitudes and that he apply these at an appropriate institution. (3) That he have an appropriate set of interests. (4) That he have a qualifying set of personal characteristics.

ACCOUNTABILITY IN HIGHER EDUCATION: POLICY SPRINGBOARD FOR REFORM

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John Crowl writing in the March 1, 1971 issue of **The Chronicle of Higher Education** under the headline "State Colleges Face Austerity, Accountability" makes the following statement:

> In most of the 48 state legislatures holding regular sessions this year, two trends affecting higher education appear to be taking shape: Funds for fiscal 1971–72 will be extremely tight, and the legislatures intend to keep a close watch on how institutions spend the money that is appropriated.
>
> In response to a survey by **The Chronicle of Higher Education** about legislative prospects for the coming year, statewide boards of higher education frequently used the terms "austerity" and "more accountability."

America's colleges and universities face fiscal pressures from which there is no escape save thorough and widespread reform to achieve increased productivity. Accountability is the policy demand to objectively relate inputs to outputs. In terms of resources allocated, the American system of higher education is the most expensive in the world. Given the "Baumol Crunch,"[1] it is hardly surprising that sharp questioning now attends its productivity.

To meet the demands of accountability––to relate resources to learning and accomplishment––colleges must reform: (1) the manner in which they deliver educational benefits; (2) the traditions which undergird their purposes; (3) the leadership styles and competencies of those who manage; and (4) the manner in which they are evaluated and subsequently improved.

And they must accomplish this reform in an enterprise which:

1. spends a shockingly inadequate less than one-third of one percent of its budgets for research and development;
2. does not use the research and development it has;
3. lacks a technology of instruction;
4. lacks an orderly means of cooperation in behalf of its clients; and
5. has few effective mechanisms for productive discussion and negotiation with its personnel.

Elsewhere I have discussed some strategies to accomplish this reform.[2] In general it will take the adoption of clear accountability policies, the setting aside of developmental capital to be administered through grants-management, the use of limited and pin-pointed performance contracting with staff, the use of professionally sound independent reviewers of accomplishment, and the employment of know-how from the rapidly growing field of educational systems technology.

Educational accountability in policy form demands a student-centered approach.[3] It specifies the formulation of educational goals and objectives which serve both as guides for action and guidelines for measuring progress toward satisfactory implementation of the goals and objectives. It insists upon the responsibility of departments and colleges for providing educational benefits for every student accepted for enrollment and for preventing failure. It provides for objective reports on the performance of students and of units of faculty and on progress of the college toward fulfilling its institutional purposes. And it also provides for experimentation with new techniques for systematic improvement and discarding of ineffective and inefficient processes.

Under the accountability aegis, learning is kept in primary focus. While courses are needed, they are seen as sub-systems, groupings of components thought to effectively and efficiently achieve desired and clearly communicated objectives consistent with and derived from institutional purposes.

Learning is an active process. To optimize it, the student must interact with teachers and materials, other students, etc. Present practice in too many colleges reveals that in the classroom students actually spend very little time actively learning--some evidence would put the figure as low as two percent. Where this occurs, it leads to enormous waste when one considers: the number of students, the annual costs, the time spent, and the number of unsuccessful learners.

In some classrooms, the only person who is active more than a fraction of the time is the teacher, engaged primarily in: preparing and delivering lectures to students whose motivation for paying attention may be insufficient, and preparing, administering and grading tests and other assignments which, because of the methods applied and/or the primitive instructional technology used, have little value in helping the students to learn, or the teachers to judge their own effectiveness. This ineffective and inefficient process can be carried out in expensive facilities in which during large amounts of time: lecture halls are empty, laboratory equipment is unused, and libraries are used sparingly.

The reform needed is possible only through a faculty and administrative agreement to change from group-paced, time-contingent learning to a personalized performance or results-contingent learning. This means: (a) learning material organized in units that can be made available in alternate versions to meet individual needs or learning styles and that can be easily updated to incorporate innovations in teaching technique and not knowledge; (b) individual contact by each student with teachers and peers as well as small group encounters; (c) a supportive educational logistics; and (d) a faculty with demonstrated competence to perform teaching activities having substantial promise to optimize learning in students.

A college or university may have many roles--research, community service, professional training, etc. Considering that the central aim is to facilitate learning in students, everything else that an institution does in the name of education which is not directly supportive of this goal needs close scrutiny and justification.

College personnel are accountable for:

1. the provision of a rewarding experience for a student who asks questions and discovers answers;
2. the stimulation of each student to determine and solve learning problems with increasing independence;
3. the provision of an environment that facilitates the process of learning;
4. the prescription of learning activities best suited to each student's entering repertoire;
5. the provision of instruction leading to accomplishment of objectives, using media and modes suited to individual and preferred learning styles;
6. the use of positive motivation through scheduling of desirable events that are

contingent upon satisfactory completion of objectives;

7. the use of evaluation and feedback at frequent performance-based intervals permitting direct guidance to student and teacher;

8. the provision of special supplementary and/or remedial activities to strengthen the learning process.

College presidents, deans, teachers, regents, and others interested in furthering increased productivity in higher education might consider the following seven-point action program:

1. Adopt and implement specific accountability policies, i.e., policies that stress unit and system results that can be independently reviewed and reported.

2. Manage systematic educational process to get good practice into prevailing practice in the classrooms and learning centers.

3. Set aside money as development capital to serve as educational R & D money.

4. Provide rewards for high priority results.

5. Institute a collegial quality control procedure for all programs.

6. Use performance contracting with staff as part of the R & D program on a turnkey basis.

7. Involve the staff and students, in the design and implementation of the productivity program.

Getting more and better results for a reasonably increased amount of dollars over the next several years is ***the*** central requirement for higher education. This can be achieved only through reform in management, delivery of benefits, and basic operating philosophy. Accountability is the collection of policy declarations to facilitate those reforms.

Faculty can strengthen their economic and professional positions by aggressively leading efforts to meliorate the following six conditions in ways which are listed. For each condition, the leadership required is outlined.

Condition 1. Within the university community, there is widespread misunderstanding of the nature of the learning process, how learning takes place and what is actually learned by the students.

Leadership required:

1. to help students clarify their own objectives and to link them to learning activities provided

2. to have students share responsibility for defining instructional objectives

3. to encourage students to have a voice in decisions about the teaching methods used

4. to have students participate in the evaluation of their learning experiences

5. to have students participate in the decisions controlling their university life as well as the change process in the university

6. to design effective learning systems:
   (a) to define objectives
   (b) to select from among a variety of approaches or combinations of approaches to meet the objectives of the course and the students
   (c) to use criteria of effectiveness which:
      (1) provide for knowledge of results
      (2) permit individualization
      (3) encourage active responding
      (4) optimize costs
      (5) control time
      (6) enhance availability

7. to become, in part, a director of learning using the services of a great number of persons who may not be normally classed as "teachers" e.g., researchers, technicians, artists, members of the professions, businessmen, etc.

8. to use and welcome students on a continuous education basis

Condition 2. University students, as a general rule, come from secondary schools which are teacher and course centered. As a result many students are poorly prepared meaningfully and productively to participate in independent modes of learning (yet they are expected to have these "studentship" qualities). Independent learning modes require special skills and experience if they are to be effectively used, and if students are to benefit from participating in them.

Leadership required: Among the effective (and validated) requirements for training students in the special skills and in offering experiences required for independent modes of learning are:

1. how to derive objectives and establish priorities among them

2. how to participate effectively in group situations, this requires ––
   (a) an understanding of group discussion techniques
   (b) an understanding of group dynamics
   (c) an understanding of human relations

3. how to analyze and solve problems using scientific and analytic approaches

4. how to utilize most effectively a wide range of teaching devices from textbooks to computers.

In addition to these more general skills, students must acquire specialized skills associated with particular disciplines such as skills in statistics, experimented design, rapid reading, etc.

These general and specific *competencies* should be warranted. The essential point is that students must be prepared to utilize new techniques and that there are specialized skills associated with the learning process itself which students must be encouraged to develop. Teachers must not assume that students already possess such skills before they have been clearly demonstrated.

One additional consideration, a new kind of student is now entering the university. In some cases, as a consequence of the introduction of modern educational techniques at the secondary (and even elementary) level these students will be better prepared to participate meaningfully in new approaches than is the present generation of students.

Condition 3. In many cases university teachers fail to create systems which relate what students are expected to learn to their personal and/or social objectives.

Leadership required:

1. to relate the university to the society

2. to help students clarify the nature of the ties between what they are expected to learn and the world around them.

Condition 4. Many university teachers use negative reinforcement and the zero-sum game in the form of marking on the normal curve.

Leadership required:

1. to emphasize the positive aspects of motivation by
   (a) insuring that the methods of teaching are themselves intrinsically rewarding experiences
   (b) using the constructive information-feedback aspects of evaluation rather than its negative, personal and competitive aspects
   (c) redefining aptitude from a time base to a competency base
   (d) instituting a zero-reject program with the 90/90 objectives-based aspects of systematic instruction as a standard.

Condition 5. Although university education is becoming more and more complex, preparation for university teaching is still largely a matter of acquiring expertise in subject matter. University teaching is perhaps the only profession which has not up to now provided formal training prior to practice.

Leadership required:

1. to develop systematic approaches to the professionalization of teachers and other staff involved in university education for the purpose of improving present educational systems and to better prepare teachers for future systems

2. to establish training programs using such techniques as micro-teaching, in-service seminars, "sabbatical" training leaves, etc.

3. to provide university teachers with appropriate models designed to exemplify the best pedagogical procedures

4. to utilize adequate incentives and support to encourage faculty to become professionally trained as instructors.

Condition 6. Most college and university teachers do not see themselves as potential change agents in the improvement of instruction. Perhaps it is in part a feeling that the overall organizational structure is an impediment.

Leadership required:

1. to implement the principles of effective instruction in his own courses regardless of the overall organization structures

2. to explore and experiment with new learning models and instructional techniques

3. to create organizational structures and strategies to motivate and facilitate faculty to improve instruction on a continuous basis. Mechanisms to accomplish this include:
   (a) systematic and regular student feedback
   (b) financial support for educational experiments and developments (Educational R & D with development capital)
   (c) the service of experts (technical assistance where needed)
   (d) rewards for effective instruction (the university career structure has to be oriented towards teaching as well).

Summary. Americans are a performance-minded and results-oriented people. Whether the matter be sports, transportation, plumbing, or dental care, Americans are dissatisfied with poor performance. Until the most recent past, educational performance was thought to reside almost solely in educational input--in teachers, facilities, student aptitude, and the like. Now it is turning to include student accomplishment provided by that input. Presently students are accountable (as are taxpayers and patrons), but colleges as systems are largely independent of both quality control and accounting for performance. The price of maintaining this status-quo is continuing loss of support and accountability on the part of the clients and the financial supporters.

Burke's warning that "a nation without means of reform is without means of survival" is applicable virtually intact to the situation in higher education. Only the substitution of the word institution for nation is required.

FOOTNOTES

1 William J. Baumol, "Macroeconomics of Unbalanced Growth: "The Anatomy of the Urban Crisis," **American Economic Review,** Vol. LVII, No. 3, June, 1967, pp. 415–26.

2 Leon M. Lessinger, **Every Kid a Winner: Accountability in Education,** Palo Alto, California: Science Research Associates, Inc.

3 Leon M. Lessinger, Dale Parnell and Roger Kaufman, **Accountability: Policies and Procedures** Vol. 1: Learning, Vol. 2: Students, Vol. 3: Personnel, Vol. 4: Management, New London, Connecticut: Croft Educational Services, Inc., 1972.

OPEN FORUM

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Q. If grades do not mean anything, why give examinations?

A. (Dr. Harris) I feel the problem is that grades are typically normative reference. They are derived from teacher-made exams. We all make up exams alike two or three nights before or even the night before administration. We simply do not have or use good criterion measures, and because of this, we do not have good assessment of student performance. That does not mean we cannot obtain better measurement of student ability. The first order of business to improving instruction is to develop a better criterion measure. You are not ready to send people out to practice veterinary medicine without having some idea of what they can do. I think we are well aware of the fact that grades do not predict very much about what an individual can do in the field. The dilemma is not necessarily mine, it is ours. You have got to be able to certify to the public that the student can reach a minimum level of performance and he knows that the grades we are now giving in professional school do not do that.

There has been an effort in some cases to do away with professional certifying exams, medical boards, and bar exams, that make graduation from an accredited school the only means of being admitted to the profession. To me that would be a loss rather than a gain. By improving these examinations systematically, better things can develop.

Q. If we shoot for 100 percent mastery, some students will be in a professional curriculum well beyond the present four years. How would you handle this physically and financially? Perhaps you may propose that students go at their own rates within the limit of the standard curriculum length.

A. (Dr. Harris) That problem has been worked on by Christiene McQuire at the University of Georgia. There are some examinations on which they only expect the students to get the right answer only 20 percent of the time. They have had board certified physicians take the examinations and they just do not do any better than that. The arbitrary level of 100 percent or 85 percent has become unrealistic for some examinations. The point is to establish the criterion measures and then evaluate how well the students do. Now don't go overboard! The important thing is to develop criterion measures as a minimum standard first. Then try it out on both acknowledged experts and average students. Then set realistic levels. For example, you could set a criterion level so high that we would not have any veterinarians for the next five years. Well, the public would rather have some veterinarians that are lower level performers than none. Thus, the idea of absolute performance has got to be moderately modified by normative reference material.

Q. Does accountability for each student mean that every student will reach the goal?

A. (Dr. Lessinger) I have stressed every student accepted, that is where morality enters. The thing that makes me uncomfortable is that after we go through an elaborate screening process, and accept students, we defeat ourselves by having arbitrary high quality standards in which only 10 percent or 20 percent survive. This is really hedging your bet. If your screening procedures are adequate and you admit students with the highest aptitude, then in what will you pride yourself, graduating students who really do not need you. I make a distinction between that and the public school system. I think it is only fair to say that what might be appropriate at one age level is not at another. The accountability movement started out of concern about the poor, the black, the students who simply were not getting any benefits from the system. In Georgia, 10 percent of our first graders fail and I have had teachers who wax eloquent about how this is a good thing, that failing experience gives the student something. (Except for them I think.) I cannot conceive failure in the case of a first grader——what is it that they do? Not color the flower petal design correctly. Is this failure? To me, it is very poor criteria, a very bad moral commitment on the part of the teaching profession. In talking about graduates of professional education, I would submit that, "everyone should be a winner" within the standards set by the profession. A rule of thumb practiced by the Armed Forces and industry is to develop programs that give you 90 percent of the people that you accept achieving 90 percent of the objectives you set. Now that may be a little too high for you, but it is a good target to shoot for.

Q. Yesterday you began saying that we should begin listing characteristics of a good veterinarian. Give us one suggestion on how we might get started. What would be one characteristic of a good veterinarian?

A. (Dr. Gardner) Well, as I said rather facetiously yesterday, in defining a good veterinarian would it be that the dog smiled when you gave him a shot. I think what you have to do is really look at the behavior of practicing veterinarians. As Dr. Harris, suggested, I think you have to go to the top quality veterinarians, observe them, talk with them, and note what they do that leads to their success. Note the way that they interact with the client, how they handle the animal. For example, a veterinarian friend of mine greets my dog with, "Hi, Hans." He had memorized his name. I love him for it. Now to me this is a characteristic that is very important and it ought to be encouraged. There are large numbers of other characteristics. You do not want to graduate hostile professionals. What manifestations of hostility are there? Turn it around and state: what do we want the student to do? This will lead you to a behavioral objective that can be tested.

Q. How was the veterinary aptitude test devised and what correlation is there between performance on the veterinary aptitude test and the National Board exam?

A. (Dr. Owens) The tests were devised by giving a sample of veterinary students the old medical aptitude test initially and selecting from it the subsections that correlated with success in veterinary medicine. A second step was devised by correlating course grades in pre-veterinary work with success in veterinary medicine and picking out the pre-veterinary courses which correlated most with success in veterinary medicine. Thus subjects like chemistry and zoology are included with the achievement section of the test and the ability to read and understand content are listed in the aptitude section of the test.

If you ask me for evidence that people who score high on this test are, in fact, better veterinarians, then you ask me a question which I or no one else can answer. You are going to have to define what is a good veterinarian. This is an extremely difficult

task. One possibility is to define it in terms of tenure. Another in terms of service and reputation. Maybe you want to put all these together. When you get into the field and start making job analyses, you are going to have to know what the good veterinarian can do or will do, that the poor one cannot or will not do. This job analysis can take several gorms. When you are through, you may be able to say something about what is an effective practitioner. If somebody will tell me what a good veterinarian is I will be glad to relate the test to it. Until that time we will have to relate it to success in veterinary school.

(Dr. Reed) Dr. Harris, I was interested in your comment about serving time and the effect this evidently has upon students later in life concerning attitude toward the educational process. Several years ago we conducted a survey on how many adults were interested in education after they finished their terminal program. The results were: somewhere between 15 to 20 percent were interested in using such things as organized continuing education programs. If we keep track of people who attend organized continuing education programs, we find that this is about 15 percent–20 percent also. Now this is not to say that others are not continuing their education in other ways, but only 15 percent–20 percent are attending programs similar to their previous experience in education.

Q. Are the State Boards of Examiners fulfilling the purpose of external examiners in professional schools?

A. (Dr. Harris) I really do not know. I do think there is a general fault in this culture as a whole. We have got to move more toward performance and situation tests rather than our complete reliance on paper and pencil tests. It is going to take a massive amount of development capital to get it done. Performance on aptitude tests predict grades in veterinary schools because grades are contingent on doing well on paper and pencil tests. But getting those good grades does not seem to tell us much about how effective the veterinarian will be in the field. To assess this we have to move to more clinical situational tests. I would say that from what I know about external ex..minations, they are generally deficient in this area.

Q. What is the better grading system, letter grades or pass/fail? Do you feel there is a greater tendency toward mediocrity of students on a pass/fail system of grading?

A. (Dr. Gardner) If you can accept the notion of performance criteria as a basis for providing feedback to the students, so that the student knows how effective he is and to what extent he is moving toward the expected outcome, then I do not think that pass/fail promotes mediocrity at all. In fact it leads toward something that I think we value very highly in our country and that is cooperation, not severe competition. When you specify objectives very clearly, you are not playing games with your student. When I achieve the objective, you are completely immoral if you fail me. This cannot lead to mediocrity and the students know and you know the performance level by the standards that have been established.

(Dr. Lessinger) I would like to comment. I think this is really the heart. We are dealing with mindset. You will recall a hundred years ago when they first attempted to get physicians to wash their hands after discovering that they were in large part contributing to the demise of their women patients in childbirth. They had an awful time, because they were touching at the heart of the matter which is a change in mindset.

It is very easy for me to step aside and chastise you and pretend that I am not a part of the problem. We all are. We all have a

mindset that is very powerful. You will find yourself and I find myself constantly worried about this notion of the screening and sorting. We really have an educational tradition that starts in the very first grade and continues all the way through, which is that somebody has to be the winner and somebody the loser.

The new approach changes this basic set and redefines aptitude. It flies in the face of the idea that you cannot make a silk purse out of a sow's ear. That is not true. You can. It is a matter of cost and benefits. It is economics that is influencing the decision. If you want to spend time and enough resources, you could move virtually everyone from one point to another. Now it may be that this is not a sensible solution. Society has all sorts of opportunities, but that is quite different from putting the accountability on the student. I just wanted to stress that this is a radical and new basic definition tearing up the old roots. This says that when you accept a student, and work with him long enough and have developed the right systems, he will succeed. Obviously reality is there. There are costs and benefits. For some students it is just too long and maybe they should do something else. This is quite different from talking about some students being good and some being bad. In fact there is some research to show that if you proctor some of our "good students" as to learning and forgetting, maybe the slow, dumb bunny may actually have better learning.

Q. If everybody can learn, why not randomly select our students that are entering into the school?

A. (Dr. Lessinger) I am not trying to fly in the face of interest or economics. You may have read in Time Magazine of the mongoloid idiot who was learning poetry. There is vast promise in the human being. We have got such fantastic promise just because we are living and alive and can learn in so many ways. Interest, speed of learning, and the individual learning style are quite different from dividing up students on some unitary scale telling the good guys from the ding-a-lings. For reasons that are obvious in terms of the allocation of resources, it is important to do some screening and to find those who are interested and have the attitude and aptitude. But I want to stress, once you say, "Yep, you're in," then to me there is a moral obligation. You are accountable to that student, or else you should not allow him in your program. Otherwise it seems to me the educational profession is just not an accountable profession.

Q. According to what we have learned the last three days, a course evaluation passed out to the students at the end of the course complied by the instructor is a red herring. Evaluation should be taken from a master student, but have we eliminated the necessity of a handout evaluation?

A. (Dr. Harris) Obviously, the more direct the better evaluation is of the teacher. How much do the students learn out of the objectives that have been publicly stated, and that the students and his colleagues understand as well? That is the most direct measure and if we approach that, there will be less necessity of placing so much weight on students' opinions of the teacher. There are a number of studies that indicate that the atmosphere under which students study has a lot to do with the attitude toward the discipline itself. Let us assume that one teacher gets an equivalent set of students to accomplish the same mastery goals as another one does, but the second group got there by being pushed, shoved, and cajoled, everything is very unpleasant for them. Everything we know about learning, animal as well as human is: If you learn under pleasant circumstances, you avoid confusion.

Your earlier point was that only 20 percent of the people want to come back to learn in

a similar manner to what they learned. In the future, moving toward a more direct assessment of student learning, can be a primary way of rating the teachers. If not as important, at least a close second, is the way he helps you get there. The extent that it is positive, pleasant, and so forth, there will be a greater encouragement for students to come back. To illustrate, I do not like libraries. I have spent a lot of time in libraries, but today I just do not go to libraries. Now that is a bad admission. I have said that to some librarians and it bothers them. Many of you may like to spend a whole day in a library, but I bet not all do, and if you have graduate students, you will send them to the library before you will go. I think that is where student evaluation will come in, in teaching.

Q. What are some references, books and so forth, on career development and planning requirements particularly to the choosing of a job within the veterinary profession, small animal medicine, large animal medicine, academia, and administration?

A. (Dr. Owens) I cannot really give you these off the top of my head, but I will look them up for you and put them as an addendum to the brief notes that I have for your proceedings. I really doubt that there is anything real specific about your profession outside the literature of your profession.

Q. Has not the cooperative extension service of the land grant universities been a university without walls, no degrees given and integrating learning and working together?

A. (Dr. Harris) That is one of the best examples of learning in the context of need to know and problem solving. It is certainly where it is worked best. I think we are going beyond that now. We are going to be willing to give people academic or professional recognition if they can demonstrate the competencies that compose the constellation of whatever that profession is. I am working with a group on the possibility of regional examining universities that would examine people in all post secondary experiences and give them credit and even degrees for anything they do. The state of New York has its college proficiency program that is operating and doing well. The University Without Walls at Antioch is another example of this. The idea that information is richly dispersed in the culture today and that the need to continue to learn is so strong that you credit people for their competencies without concern for their sitting on campuses and getting it. Some people may need to sit to get it and some people may get it alone. But how they get there is unimportant as long as you are sure that they got there.

Q. What is the proposed reward to a teacher for being more effective in carrying out his responsibilities?

A. (Dr. Lessinger) I am going to give you a simple minded answer because I do not know a complex one. One critic accused this of being cynical, but it is not. You can carry this too far, and that is why I try to balance what I say. I think that you are talking about the chain strategy. You are really talking about developing consequences to behavior. There is no question that when you talk about accountability, you have got to talk about what responsibility have I, and to whom, and then quickly add the consequences. That does not mean we have to go all the way with Skinner.

We are accountable and there are consequences and we are rewarded. Now there is the old business about publish or perish and not rewarding teaching. Thus, the first answer is there must be rewards, carefully tailored to the objectives that we want. To not provide them is a lack of system accountability. The other part of this is, this may sound romantic, that one of the major rewards of teaching is what I would call a celebrative experience with which I

have been impressed with over the years. My original training was as a mechanical engineer which did not provide me very much in terms of capability. I was a good example of the old system. I am glad because I never would have passed if they had competency. I had competence only in taking tests. For example, I am a machinist, too, and I can actually cut a thread on a die. The only thing is that the nut will never fit on the bolt, but it looks good. It looks like the kind of thread that should work. Perhaps I can teach you how to do it, however, I cannot really do it because no one ever made me cut a thread to specification.

It seems to me one of the rewards is this celebrative experience. When I left engineering, I went into clinical psychology. I was very interested in Freud's notion of what he called the oceanic experience, what William James calls the mystic experience, what Mazlow calls peak experiences and what I myself have detected, and am sure you have, is the sort of a warm feeling of thanksgiving that one is competent and able to serve. I think it is possible to talk meaningfully about engineering such experiences and the key is the overcoming of odds. It is interesting, to me at least, that we celebrate a birth and not a death. We celebrate a marriage not a divorce. We celebrate really the overcoming of the second law of thermodynamics. Life itself overcomes the odds. The Catholics celebrate the Mass. The word is celebrate, and if you are not a believer, the notion is overcoming death it: :lf through the particular ritual.

Now, on a very mundane level, it seems to me a teacher kind of gets this reward when you do overcome the odds and you take the high risk student. That does not mean the other one is not important. It seems to me one of the exciting things about a profession is that it tackles the tough problems, and overcomes them. I think the truly professional practitioner experiences this. I have talked with many people in the Peace Corps, who report that when they are competent and do something, save a life, or build a well and a community thrives where it would not have, they get this feeling described by Freud and Mazlow and others. That is part of the rewards that ought to be added.

I think it would be a mistake just to talk about those things. I would also want to very carefully look at the monetary and status rewards. I think, particularly at the university level, we really, as the Indians say, talk with forked tongue. This is an old thing. We really do not reward teaching. Therefore, the system is not accountable. It lacks system accountability and it should be addressed as a major problem.

APPENDICES

APPENDIX A

PARTICIPANT OBJECTIVES

PARTICIPANT OBJECTIVES

Prior to the Fifth Symposium the participants will have read

- **Learning for Mastery** by B. S. Bloom
- **Preparing Instructional Objectives** by R. S. Mager
- **Goal Analysis** by R. S. Mager
- summary and recommendation section of the Southern Regional Education Board report "Veterinarians for the South," and the summary section pertaining to veterinary medical education of the committee of the National Academy of Science "Report on Veterinary Medical Research and Education"
- selected reprints sent out upon preregistration;

and be able to

- describe the concept of learning for mastery and its implication for veterinary medical education
- list the three criteria for an educational objective as described in **Preparing Instructional Objectives** by R. S. Mager
- evaluate whether a given objective meets those criteria and if performance criteria conform to the concept of learning for mastery
- define a minicourse.

At the conclusion of the Fifth Symposium, the participants will have:

planned a minicourse which will consist of

- title
- objective(s) written for cognitive and/or affective domain
- performance criteria
- selected media with justification for choice
- proposed methods of evaluation;

participated in discussions of

- minicourses
- objectives
- multi-media instruction
- methods of evaluation
- National Academy of Science and Southern Regional Education Board reports on veterinary medical education;

developed a notebook containing

- copies of the formal presentations
- available commercial literature on media hardware
- copies of recommendations from the reports on Veterinary Medical Education
- copies of their planned minicourse
- copies of selected participant-planned minicourse
- notes (personal);

increased

- the number of approach reponses to mastery learning and minicourse development;

and be able to

- describe and give examples of minicourses and their application to veterinary medical education
- describe the advantages and disadvantages of "learning for mastery"
- use a storyboard to plan an enabling instructional program for educational objectives
- list advantages and disadvantages for different media and methods of presenting instructional materials and describe criteria for choosing
- operate a videotape recorder and TV camera in accordance with acceptable standards
- list formats for evaluation of a chosen competency, along with the advantages of each
- write objectives conforming to criteria outlined at the symposium
- construct a series of evaluative questions that can be used to evaluate a chosen competency
- plan a minicourse.

Upon ariving home from the Fifth Symposium the participants will

- contact five faculty members and tell them about minicourse, mastery learning, and multi-media, showing them how they can plan a minicourse
- share with these five faculty members any material from the symposium that applies to their area, and encourage and assist them in developing and producing one minicourse during the next year
- produce two additional minicourses this coming year.

APPENDIX B

PROGRAM PARTICIPANTS

PROGRAM PARTICIPANTS

A. R. Allen, M.S. – Director of Medical Instruction and Communication, School of Veterinary Science and Medicine, Purdue University, Lafayette, Indiana

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C. F. Reed, Michigan State University
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N. E. Hutton, Iowa State University
J. Lieberman, Videorecord Corporation
J. R. Welser, University of Georgia

Women's Program Committee:

Cathy Crawford, Chairman
Gale Anderson
Janice Hooper
Kathryn Welser

Local Planning Committee——University of Georgia:

M. E. Adsit
L. M. Crawford
J. W. Harris
B. E. Hooper
R. E. Lewis
J. T. Mercer
J. R. Welser, Chairman

Mr. Roger M. Copeland, Conference Coordinator, represents the Georgia Center staff as host for this Symposium.

APPENDIX C

POST SYMPOSIUM QUESTIONNAIRE

Summary of Replies to _____

POST SYMPOSIUM QUESTIONNAIRE

Rating of Activities:

		Very Appropriate	Appropriate	Inappropriate	Very Inappropriate
1.	Conference Objectives	71.8%	28.2%	0%	0%
2.	Pre-conference Readings	44.7	53.5	1.4	0.5
3.	Reports on Veterinary Medical Education	27.9	67.2	5.0	0.0
4.	Minicourse planning	36.4	54.8	7.4	1.4
5.	Assembling Notebook	38.1	56.3	5.1	0.5
6.	Discussion sessions	35.5	60.8	3.2	0.5
7.	Work groups	15.0	63.6	20.1	1.3
8.	Luncheon and banquet speakers	26.3	61.7	11.0	1.0
9.	Media displays	48.8	50.2	1.0	0.0
10.	Storyboard planning	16.9	60.0	20.0	3.1

Rating of Topics:

		Methods of Presentation				Applicability to Veterinary Medicine			
		exc.	good	fair	poor	exc.	good	fair	poor
1.	New Horizons for Veterinary Medicine	35.4%	53.1%	11.5%	0.0%	56.8%	37.4%	4.7%	1.1%
2.	Veterinarians for the South	11.8	51.9	25.1	11.2	36.3	44.0	17.3	2.4
3.	Minicourses	43.1	44.5	11.0	1.4	60.6	35.8	3.1	0.5
4.	Performance Objectives	50.5	43.7	4.9	1.0	66.3	30.5	3.2	0.0
5.	Media –								
	– presentation	35.2	52.0	11.2	1.7	53.2	42.9	3.2	0.6
	– slide tape	37.5	51.1	11.4	0.0	60.2	37.3	2.4	0.0
	– film	31.1	49.7	13.9	5.3	56.8	41.3	2.6	0.0
	– T.V.	35.8	45.7	14.6	4.3	55.1	35.3	9.0	0.6
	– Library Resources	26.2	46.4	22.0	5.4	46.5	45.3	6.3	1.9
	– Computer	29.9	51.7	14.9	3.4	39.1	39.7	14.7	6.4
6.	Evaluation								
	Mastery learning	43.1	42.7	10.9	3.3	50.0	40.7	7.1	2.2
	Pre-testing	17.9	46.2	26.7	9.2	37.9	49.2	10.7	2.3
	Post-testing	20.3	50.3	19.8	9.6	43.6	45.4	9.1	1.8
7.	Criteria based curriculum	37.7	49.3	11.6	1.4	52.5	40.9	6.6	0.0
8.	Career Planning	24.6	46.3	25.1	3.9	41.3	41.3	17.3	0.0
9.	Accountability	64.5	32.2	3.2	0.0	69.1	28.2	2.1	0.5
10.	Research in Education	38.3	45.4	13.7	2.7	62.1	25.9	11.2	0.9